"EFFECTS OF UPPER EXTREMITY ISOMETRIC EXERCISES ON CARDIOVASCULAR RESPONSES IN NORMAL AND OBESE INDIVIDUALS''

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CHERRAAN'S INSTITUTE OF HEALTH SCIENCES

COIMBATORE, TAMILNADU, INDIA

MAY-2019

CERTIFICATES

CERTIFICATE

This is to certify, that is the bonafide record of project work, done by candidate bearing University Registration Number 271730162 and submitted for the partial fulfillment of **MASTER OF PHYSIOTHERAPY** Degree course requirements at **CHERRAAN'S COLLEGE OF PHYSIOTHERAPY,** COIMBATORE, under **THETAMILNADU DR. M.G.R. MEDICAL UNIVERSITY**CHENNAI.

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Project work evaluated on _________________________

DECLARATION

DECLARATION

The work embodied in this project **entitled “EFFECTS OF UPPER EXTREMITY ISOMETRIC EXERCISES ON CARDIOVASCULAR RESPONSES IN NORMAL AND OBESE INDIVIDUALS”** was the original work carried out by me and has not been submitted in part or full for any other degree/diploma at this or any other institute/university. All the ideas and references have been duly acknowledged.

____________________________ ____________________________

Signature of supervisor Signature of student

Mr.V. Karthik MPT, MBA, PGDF, CMT, MIAP

Professor

Date: _________________________

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

First of all I express my sincere gratitude to the GOD ALMIGHTY**,** who has given me the required knowledge, wisdom, strength, & opportunity to do this project successfully.

This study will be an incomplete one without my gratitude towards my PARENTS& FRIENDS.

I want to acknowledge my sincere thanks to our CHAIRMAN, & all other staffs of CHERRAAN INSTITUTE OF HEALTH SCIENCE, Coimbatore.

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I owe my sincere thanks to MR.V.KARTHICK, M.P.T, MBA, PGDF, CMT, MIAP PROFESSOR my guide for his inspiration, assistance & support, from the inception of this research study to its completion.

I take this opportunity to thank each & every PATIENTS who took part in this study for their kind co-operation & needed information.

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ABSTRACT

"EFFECTS OF UPPER EXTREMITY ISOMETRIC EXERCISES ON CARDIOVASCULAR RESPONSES IN NORMAL AND OBESE INDIVIDUALS''

DESIGN: This study is a pre-test and post-test experimental design in nature.

PARTICIPATIONS: Group A consists of 50 young adult individuals and group B consists of 50 young obese individuals.(N=100)

Materials and Methods: Samples were randomly selected and the study population included only those who met the inclusive criteria. The basic were taken and recorded (age, height, blood pressure heart rate). Group A consists of 50 normal subjects and group B consists of 50 obese individuals.(N=100)&GROUP A (YOUNG) and GROUP B (YOUNG OBESE) participate in (1) Upper extremity isometric exercises by pushing against the wall with outstretched arms. (2) Isometric contractions by using the hand held dynamometer. (3)The hands clasped together and bought to the manubrio sternal level of the shoulders in 80-90 degree of abduction. Pre-test and post-test measured.

OUTCOME MEASURE:

- Blood pressure
- Heart rate
- Rate pressure product

RESULT: The results of this study thus concluded that there are significant differences in cardiovascular responses in normal and obese individuals, after an upper extremity isometric exercise.

CONCLUSION: This study will be useful for prescribing exercise for obese to improve the cardiovascular fitness.

INTRODUCTION

CHAPTER - I

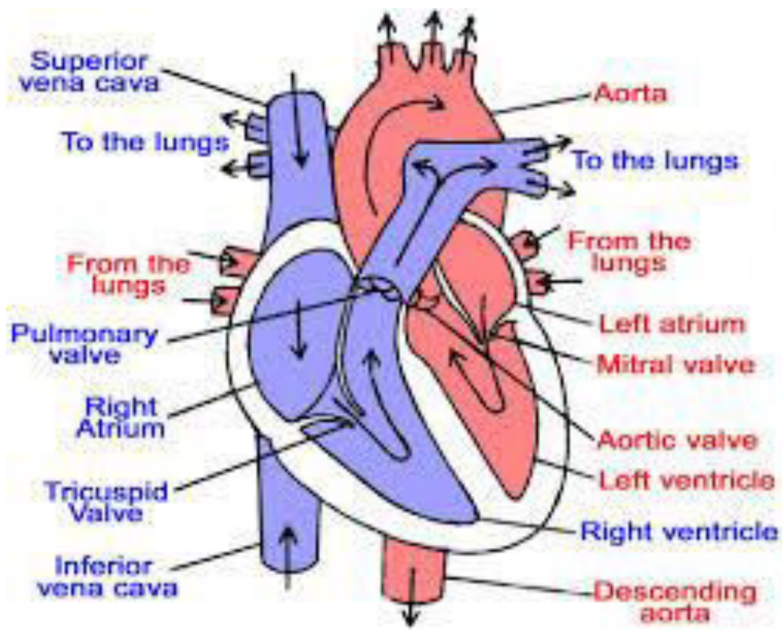
INTRODUCTION

Structure of the Heart **-** The heart is a muscle about the size of a fist, and is roughly cone-shaped. It is about 12cm long, 9cm across the broadest point and about 6cm thick. The pericardium is a fibrous covering which wraps around the whole heart. It holds the heart in place but allows it to move as it beats. The wall of the heart itself is made up of a special type of muscle called cardiac muscle.

Chambers of the Heart - The heart has two sides, the right side and the left side. The heart has four chambers. The left and right side each have two chambers, a top chamber and a bottom chamber. The two top chambers are known as the left and right atria (singular: atrium). The atria receive blood from different sources. The left atrium receives blood from the lungs and the right atrium receives blood from the rest of the body. The bottom two chambers are known as the left and right ventricles. The ventricles pump blood out to different parts of the body. The right ventricle pumps blood to the lungs while the left ventricle pumps out blood to the rest of the body. The ventricles have much thicker walls than the atria which allows them to perform more work by pumping out blood to the whole body.

Blood Vessels - Blood Vessel are tubes which carry blood. Veins are blood vessels which carry blood from the body back to the heart. Arteries are blood vessels which carry blood from the heart to the body. There are also microscopic blood vessels which connect arteries and veins together called capillaries. There are a few main blood vessels which connect to different chambers of the heart. The aorta is the largest artery in our body. The left ventricle pumps blood into the aorta which then carries it to the rest of the body through smaller arteries. The pulmonary trunk is the large artery which the right ventricle pumps into. It splits into pulmonary arteries which take the blood to the lungs. The pulmonary veins take blood from the lungs to the left atrium. All the other veins in our body drain into the inferior vena cava (IVC) or the superior vena cava (SVC). These two large veins then take the blood from the rest of the body into the right atrium.

Valves -Valves are fibrous flaps of tissue found between the heart chambers and in the blood vessels. They are rather like gates which prevent blood from flowing in the wrong direction. They are found in a number of places. Valves between the atria and ventricles are known as the right and left atrioventricular valves, otherwise known as the tricuspid and mitral valves respectively. Valves between the ventricles and the great arteries are known as the semilunar valves. The aortic valve is found at the base of the aorta, while the pulmonary valve is found the base of the pulmonary trunk. There are also many valves found in veins throughout the body. However, there are no valves found in any of the other arteries besides the aorta and pulmonary trunk.



Functions of blood and circulation - Circulates OXYGEN and removes Carbon Dioxide., Provides cells with NUTRIENTS., Removes the waste products of metabolism to the excretory organs for disposal., Protects the body against disease and infection., Clotting stops bleeding after injury., Transports HORMONES to target cells and organs., Helps regulate body temperature.,

The cardiac cycle is the sequence of events that occurs when the heart beats. As the heart beats, it circulates blood through pulmonary and systemic circuits of the body. There are two phases of the cardiac cycle. In the diastole phase, the heart ventricles are relaxed and the heart fills with blood. In the systole phase, the ventricles contract and pump blood out of the heart and to arteries. One cardiac cycle is completed when the heart chambers fill with blood and blood is then pumped out of the heart.

The cardiovascular system is the system that circulates blood throughout the body. Cardiovascular exercises increase the blood flow in our body which in turn also increases the number of Red blood corpuscles. The cardiovascular system is one of the most important components during the exercise performance and it compensate for the increased metabolic demand during exercise.

Cardiovascular responses to exercise depend accordingly to the type of exercise either dynamic or static. Isometric is a static exercise with muscle contraction without changes in the length of muscle. Isometric exercise has been reported to lead an increase in cardiovascular responses due to decreased vagal tone and increased discharge of cardiac sympathetic nerves. In spite of this, isometric exercise plays an important modality in patient's rehabilitation among physical therapists. The upper extremity isometric exercises are mainly prescribed for the sportsman and boxer to strengthen the upper limb muscles. The positive effect of upper extremity isometric exercise is to strengthen the muscles by increasing more blood flow to the muscle. The main drawback of upper extremity isometric exercise the peripheral vascular resistance which alters the cardiovascular responses.

Cardiovascular disease caused 2.3 million deaths in India in the year 1990 and this is projected to double in the year of 2020. Hypertension is directly responsible for 57% of all stroke deaths. This is a strong correlation between changing the lifestyle factors and increase in hypertension in India. The changing lifestyle also leads to obesity.

The prevalence of obesity world-wide is increasing rapidly. The world Health Organization has designated obesity as a major health problem throughout the world. In 995, there was an estimated that over 115 million people suffer from obesity related problems.

Obesity increases the likelihood of various cardiac diseases. One of the major risk factor in obese is Hypertension. The prevalence of Hypertension is more in developing countries with the people who all are obese.

Isometrics has been reported to lead to increase cardiovascular changes. There are lots of conflicting studies on isometrics in cardiovascular responses. Indeed no studies address the exact cardiovascular response during upper extremity exercises. There is less number of studies stating that hemodynamic changes to an upper extremity isometrics in obese patients. Most of the studies of upper extremity isometric exercise stating that there is an increased heart rate and increased blood pressure in the healthy population. But few of the studied said that 8 week of hand grip isometric exercise reducing the blood pressure. No studies compared the normal healthy individuals with the normal obese. Hence the study would determine the cardiovascular responses in normal and obese after the upper extremity exercises.

Blood Pressure is the force between the walls of the blood vessels. Normal Blood Pressure is 120/80 mmHg. Systolic Pressure is 120 mmHg & Diastolic Pressure is 80 mmHg.

Pulse, rhythmic dilation of an artery generated by the opening and closing of the aortic valve in the heart. A pulse can be felt by applying firm fingertip pressure to the skin at sites where the arteries travel near the skin's surface; it is more evident when surrounding muscles are relaxed.

A normal resting heart rate for adults ranges from 60 to 100 beats per minute. Generally, a lower heart rate at rest implies more efficient heart function and better cardiovascular fitness. For example, a well-trained athlete might have a normal resting heart rate closer to 40 beats per minute.

1.1 STATEMENT OF THE STUDY

A study is to find out the cardiovascular responses in young adult individuals and young obese individuals following upper extremity isometric exercise.

1.2 NEED OF THE STUDY

As per the study of D.R. SEALS, P.B. CHASE, J A TAYLOR et al (1998), he has determined that isometric handgrip exercise will increase the arterial pressure and heart rate at initial 1.5 million of exercise.

As per the study of WP LAIRD, DE FIXLER, HD HUFFINES et al (1979), he has stated that cardiovascular response to sub maximal isometric exercise in normal adolescents is similar to the adults.

As per the study of JERE H. MITCHELL, MASAKI MIZUNO, SCOTT A. SMITH, M. DANKIN et al (1974), he has said that static isometric causes marked increases in mean arterial pressure and minimal in heart rate.

Based on above analysis, they have concluded that blood pressure will increase after the isometric hand grip exercises.

Thus, the inference / findings of my study will help to refine the principles to prescribe therapeutic module of exercises for obese individuals to improve the cardiovascular fitness according to their cardiovascular response.

1.3 AIM

The aim of the study is to find out the cardiovascular responses in normal and obese individuals following upper extremity isometric exercise.

1.4 OBJECTIVE OF THE STUDY

- To determine the effectiveness of isometric upper extremity exercises by pushing hands against wall in young and young obese patients
- To determine the effectiveness of cardiovascular response by isometric upper extremity exercise with Hand Held Dynamometer in young and young obese patients.

- To determine the effectiveness of cardiovascular response by isometric upper extremity exercise with hands clasped together at the manubriosternal level of the shoulders in 80 to 90 degree of abduction in young and young obese patients.

1.5 HYPOTHESIS

The following hypothesis are framed for this study

NULL HYPOTHESES

There is no significant change in cardiovascular responses in normal and obese subjects following upper extremity isometric exercises.

ALTERNATE HYPOTHESES

There is significant change in cardiovascular responses in normal and obese subjects following upper extremity isometric exercises.

1.6 OPERATIONAL DEFINITIONS

- **BLOOD PRESSURE**
  - The force of circulating blood on the walls of the arteries.
  - It has 2 measurements
    - Systolic
    - Diastolic
- **HEART RATE**
  - The number of Heart beat per minute
  - The average Heart rate is 72 beats/minute

- **ISOMETRIC EXERCISE**
    - It is a type of Strengthening exercise during contraction, the muscle length will not change and without movement of the joint
- **CARDIOVASCULAR RESPONSE**
    - Changes in the Blood pressure and Heart rate by doing exercise

REVIEW OF LITERATURE

CHAPTER – II

REVIEW OF LITERATURE

SECTION A:

Studies related to the changes in cardiovascular response by isometric exercise depend upon the health of the people.

SECTION B:

Studies related to the changes in cardiovascular response by isometric exercise in obese people.

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SECTION A: Studies related to the changes in cardiovascular response by isometric exercise depends upon the health of the people.

- **DONMELROSE et al (2005)**Gender Differences In Cardiovascular Response To Isometric Exercise In The Seated And Supine Positions. JEPonline. 2005;8(4):29-35. The purpose of this study was to 1) determine if the cardiovascular responses to isometric exercise differ between genders, and 2) determine if posture affects cardiovascular responses to isometric handgrip (IHG) exercise. Sixteen women and 15 men (age 22.6±4.2 yrs) performed two randomized (seated or supine) maximal IHG trials at 40 %MVC one week apart. Blood pressure (BP) and heart rate (HR) measurements were collected at rest (RT), the first minute of exercise (M1), prior to failure (PF), and at 30 s of recovery following failure (RC). Mean arterial pressure (MAP), pulse pressure (PP), and rate pressure product (RPP) were calculated from BP and HR data. Analyses showed significant time by gender interactions for diastolic blood pressure (DBP) and MAP. Males had significantly higher DBP than females at M1 (105.46±14.97 vs. 92.59±13.14 mmHg), PF (122.46±11.23 vs. 109.50±13.72 mmHg) and RC (85.83±4.11 vs. 73.46 ± 8.35 mmHg) and higher MAP measurements than females at M1 (120.32 ± 13.76 vs. 105.43 ± 13.76 mmHg), PF (136.44 ± 8.65 vs. 24.31 ±13.34 mmHg), and RC (100.44 ±8.21 vs. 87.67 ±8.26 mmHg). DBP, MAP, and HR were significantly higher in the seated position than in the supine position for both genders. It was concluded that 1) men significantly increase MAP and DBP upon initiation of submaximal IHG exercise through recovery regardless of posture, 2) women have significantly lower blood pressure measurements than men during submaximal IHG exercise regardless of posture, and 3) posture has a significant affect on cardiovascular response during submaximal IHG exercise. In conclusion, the current investigation shows that; 1) cardiovascular and hemodynamic responses to submaximal levels of isometric handgrip exercise do differ by gender specifically at the onset of exercise and 2) posture does affect cardiovascular responses to isometric exercise. Factors responsible for differences in cardiovascular response due to gender appear to be numerous and in need of further study to definitively elucidate specific mechanisms.

- **W P LAIRD , D E FIXLER , AND F D HUFFINESet al (1979)** The purpose of this study was to document the cardiovascular response to submaximal isometric handgrip (IHG) exercise in 32 normal adolescents. Left ventricular (LV) dimensions and systolic time intervals were recorded using echocardiography; blood pressure was measured by sphygmomanometry both at rest and during IHG exercise at 25% maximum contraction. This level of isometric exercise produced significant (p less than 0.001) increases in mean heart rate, systolic, diastolic and mean blood pressures. Despite this response LV diastolic and systolic dimensions remained unchanged during exercise; hence, stroke volume remained constant. Cardiac index increased by 22% (p less than 0.001) due to the increase in heart rate. Systemic vascular resistance did not change significantly. LV ejection indices, including shortening fraction, mean Vcf and systolic time intervals also remained unchanged, except for an increase in LV ejection time index (p less than 0.025). These data indicate that the cardiovascular response to submaximal isometric exercise in normal adolescents is similar to that reported in adults. This study demonstrates that sustained isometric stress testing in adolescents is safe and provides normal hemodynamic values.

- **GILBERT W. GLEIM, JAMES A. NICHOLAS et al (1986)**To quantify normal biological variability of shoulder abduction strength testing with an isokinetic and a hand-held dynamometer, we tested nine healthy sub jects over a clinically relevant period. One side was tested with a Cybex at 60 deg/sec and the other with a hand-held dynamometer. Six maximal trials, following warmup, were conducted on each of 5 days, separated by 1 to 2 weeks. Intraday correlations of individual trials ranged from 0.82 to 0.995 for hand-held dynamometer, and 0.88 to 0.996 for Cybex. Interday correlations ranged from 0.94 to 0.98 for hand-held dynamometer, and 0.88 to 0.97 for Cybex. The best values to use for Cybexinterday variability were the average of the first three repetitions, and yielded standard errors of 8.6% to 19.2% of the sample mean. The average of the last three repetitions were the best for hand-held dynamometers, and yielded standard errors of 5.5% to 10.8%. There was a significant decline ($P < 0.05$) in strength of the mean of the last three versus the mean of the first three daily repetitions on Day 1 and 4 for hand- held dynamometers, and a trend toward this on the other days, that was not seen with Cybex. Regression of average Day 1 values for Cybex and hand-held dynamometer yielded $r = 0.86$ ($P < 0.01$) with a slope of 1.07 indicating good agreement between modalities. In conclusion, intraday/interday correlations were high for Cybex and hand-held dynamometer. Interdayvari ability was minimized by using the mean score of the first three and last three repetitions for Cybex and hand- held dynamometer, respectively. Changes in Cybex and hand-held dynamometer strength of less than 19% and 11 %, respectively, are within the area of "measurement error" and should therefore not be considered clinically significant. They have stated that cardiovascular performance depends upon number of factors that function to meet the metabolic needs of the body during the isometric exercise.

- **J F BABALOLA et al (2007)**They have stated that rate pressure product is increased in females than males after upper extremity isometric exercise.

- **WP LAIRD, DE FIXLER, HD HUFFINES et al (1979)**The purpose of this study was to document the cardiovascular response to submaximal isometric handgrip (IHG) exercise in 32 normal adolescents. Left ventricular (LV) dimensions and systolic time intervals were recorded using echocardiography; blood pressure was measured by sphygmomanometry both at rest and during IHG exercise at 25% maximum contraction. This level of isometric exercise produced significant (p less than 0.001) increases in mean heart rate, systolic, diastolic and mean blood pressures. Despite this response LV diastolic and systolic dimensions remained unchanged during exercise; hence, stroke volume remained constant. Cardiac index increased by 22% (p less than 0.001) due to the increase in heart rate. Systemic vascular resistance did not change significantly. LV ejection indices, including shortening fraction, mean Vcf and systolic time intervals also remained unchanged, except for an increase in LV ejection time index (p less than 0.025). These data indicate that the cardiovascular response to submaximal isometric exercise in normal adolescents is similar to that reported in adults. This study demonstrates that sustained isometric stress testing in adolescents is safe and provides normal hemodynamic values.They have stated that cardiovascular response to sub maximal isometric exercise in normal adolescents is similar to the adults.

SECTION B Studies related to the changes in cardiovascular response by isometric exercise in obese people.

- **K.DIPLA, A.ZAFERIDIS, I.KOIDAU et al (2010)**The hemodynamic responses to exercise have been studied to a great extent over the past decades, and an exaggerated blood pressure response during an acute exercise bout has been considered as an indicator of cardiovascular risk. Obesity is a major factor influencing the blood pressure response to exercise since evidence indicates that the arterial pressure response to exercise is exacerbated in obese compared with lean adults. Signs of augmented responses (such as an exaggerated blood pressure response) to physical exertion appear early in life (from the prepubertal years) in obese individuals. Understanding the mechanisms that drive the altered hemodynamic responses during exercise in obese individuals and prevent the progression to hypertension is vitally important. This paper focuses on the evidence linking obesity with alterations of the autonomic nervous system and discusses the potential mechanisms and consequences of the altered sympathetic nervous system behavior in obese individuals at rest and during exercise. They have found that the obese normotensives having the altered cardiovascular hemodynamic and reflex control after the 3 minutes of isometric handgrip exercise.

- **P VALENS, PT BICH NGOI, S IDRISS et al (1999)** they have stated that reduced blood pressure responses to a contraction in obese patients with lower sympathetic nerve activation.

- **JEAN VERDIER et al (1995)** they have concluded that cardiac autonomic dysfunction evidenced by means of reproducible test in the non-diabetic obese subjects who having poor cardiovascular prognosis.

- **D.R. SEALS, R.A WASHBURN, F.J NAGLE, et al (1983)**Nine young males with borderline hypertension (BH) (mean age +/- SD, 25 +/- 5 yr) and 13 young male normotensive controls (NT) (24 +/- 3 yr) were studied to determine their cardiovascular responses to small and large muscle static contractions. The subjects performed one-arm handgrip and two-leg extension in a randomly assigned order for 3 min at 30% of maximal voluntary contraction. Mean intra-arterial blood pressure (MABP), heart rate (HR), and tension were measured throughout the contractions. Borderline hypertensive patients had a higher MABP at rest (p less than 0.005) and at the end of both types of static contractions (p less than 0.05). The average increases in MABP from rest to the end of exercise (delta MABP) were slightly greater for the BH patients (6 mmHg), but these differences were not significant (p greater than 0.1). However, a greater percentage of BH patients were hyper reactive to handgrip (delta BP greater than 35 mmHg) and leg extension (delta BP greater than 40 mmHg) when compared to controls. These data indicate that, in general, young men with borderline hypertension demonstrate normal cardiovascular regulation in response to static contraction, but that a portion of this population may be hyperreactive to this type of circulatory stress.They have concluded that during same percentage of maximal voluntary contraction the magnitude of cardiovascular response to isometric exercise is directly influenced by the size of the contracting muscle mass.

- **HUMPREYS.P, JAMES C, SOWERS M.D, MICHALL NYBY et al (1963**) they have concluded that the isometric handgrip exercise with caloric restriction have reduced the blood pressure in obese.

SECTION C: Studies related to the changes in blood pressure and heart rate after isometric exercise.

- **CE MBADA, OA AKINWAND et al (2007)**Isometric exercises of the upper limbs can lead to a significant increase in cardiovascular parameters among apparently healthy male and female subjects. Higher ventricular contraction is evoked among males leading increased SBP while the myocardial oxygen uptake and the measure of the oxygen consumption of the heart muscles of the female participants in response to upper extremities isometric exercises is higher than that of the males as demonstrated by the RPP. They have concluded that there is a significant increase in systolic blood pressure in male than female after the upper extremity isometric exercise in healthy population.

- **D.R. SEALS, P.B. CHASE, J A TAYLOR et al (1998)**The purpose of this study was to determine the respective contributions of tachycardia and increases in sympathetic nerve activity (SNA) in mediating the pressure responses to fatiguing vs. nonfatiguing levels of isometric handgrip exercise (IHE) in humans. We performed direct (microneurographic) measurements of muscle SNA from the right peroneal nerve in the leg and recorded arterial pressure (AP) and heart rate (HR) in eight healthy subjects before (control), during, and after 2.5 min of IHE at 15, 25, or 35% of maximal voluntary contraction (MVC). They have determined that isometric handgrip exercise will increase the arterial pressure and heart rate at initial 1.5 million of exercise.

- **STANEY et al (1987)** they have stated that there is a significant gender difference is seen after isometric hand grip exercise and systolic blood pressure is high in males than females.

- **MITCHELL. J H. SCHILYE B, PAYA F C et al (1981**) They said that the increase in arterial pressure after static muscle contraction by central and peripheral control mechanism.

- **JERE H. MITCHELL, MASAKI MIZUNO, SCOTT A. SMITH, M. DANKIN et al (1974)**The cardiovascular response to physical exercise is abnormally exaggerated in hypertension. Since such responses potentially increase the risk for adverse cardiovascular events, it is clinically important to elucidate the cause of this cardiovascular hyper-excitability in this disease. Even if blood pressure is normal at rest, individuals displaying a heightened blood pressure response to exercise are more likely to develop future hypertension. Therefore, early detection of this abnormal circulatory response to physical activity could lead to the early treatment as well as prevention of hypertension. They have said that static isometric causes marked increases in mean arterial pressure and minimal in heart rate.

SECTION D: Studies related to the changes in cardiovascular response after isometric exercise by moving extremities.

- **R HOWDEN, JT LIGHT FOOT et al (2002)**Isometric exercise training has been shown to reduce resting blood pressure, but the effect that this might have on orthostatic tolerance is poorly understood. Changes in orthostatic tolerance may also be dependent on whether the upper or lower limbs of the body are trained using isometric exercise. Twenty- seven subjects were allocated to either a training or control group. A training group first undertook 5 weeks of isometric exercise training of the legs, and after an 8 week intervening period, a second training group containing six subjects from the initial training group, undertook 5 weeks of isometric arm- training. The control group were asked to continue their normal daily activities throughout the 18 weeks of the study. In all subjects orthostatic tolerance, assessed using lower body negative pressure (LBNP), and resting blood pressure were measured before and after each of the 5 week training or control periods. Estimated lean leg volume was determined before and after leg- training. During all LBNP tests, heart rate and blood pressure were recorded each minute, and the time taken to reach the highest heart rate was derived (time to peak HR). Resting systolic blood pressure (mean ± s.d.), when measured during the last week of training, was significantly reduced after both leg (- 10 ± 8.7 mmHg) and arm (- 12.4 ± 9.3 mmHg; $P < 0.05$) isometric exercise training, compared to controls. This reduction disappeared when blood pressure was measured immediately before the LBNP tests, which followed training. Orthostatic tolerance only increased after leg- training (20.8 ± 16.4 LTI; $P < 0.05$) and was accompanied by an increased time to peak HR (119.8 ± 106.3 beats min^{-1}; $P < 0.05$) in this group. Blood pressure responses to LBNP did not change after arm- training, leg- training or in controls ($P > 0.05$). There was a small but significant increase in estimated lean leg volume after leg- training (0.1 ± 0.1 1; $P < 0.05$). These results suggest that lower resting blood pressure is probably not responsible for the increased orthostatic tolerance after isometric exercise training of the legs. Rather, it is possible that the training altered some other aspect of cardiovascular control during orthostatic stress that was apparent in the changes in heart rate. Legtraining was accompanied by increases in estimated lean leg volume. The effects of isometric training on orthostatic tolerance appear to be specific to limbs that are directly involved in LBNP testing. They have found that resting blood pressure is not responsible for the increased orthostatic tolerance after isometric training of the legs.

- **Stephen J. Brown , Ian L.Swaine et al (2002)**Isometric exercise training has been shown to reduce resting blood pressure, but the effect that this might have on orthostatic tolerance is poorly understood. Changes in orthostatic tolerance may also be dependent on whether the upper or lower limbs of the body are trained using isometric exercise. Twenty-seven subjects were allocated to either a training or control group. A training group first undertook 5 weeks of isometric exercise training of the legs, and after an 8 week intervening period, a second training group containing six subjects from the initial training group, undertook 5 weeks of isometric arm-training. The control group were asked to continue their normal daily activities throughout the 18 weeks of the study. In all subjects orthostatic tolerance, assessed using lower body negative pressure (LBNP), and resting blood pressure were measured before and after each of the 5 week training or control periods. Estimated lean leg volume was determined before and after leg-training. During all LBNP tests, heart rate and blood pressure were recorded each minute, and the time taken to reach the highest heart rate was derived (time to peak HR). Resting systolic blood pressure (mean ± S.D.), when measured during the last week of training, was significantly reduced after both leg (−10 ± 8.7 mmHg) and arm (−12.4 ± 9.3 mmHg; $P<0.05$) isometric exercise training, compared to controls. This reduction disappeared when blood pressure was measured immediately before the LBNP tests, which followed training. Orthostatic tolerance only increased after leg-training (20.8 ± 16.4 LTI; $P<0.05$) and was accompanied by an increased time to peak HR (119.8 ± 106.3 beats min−1; $P<0.05$) in this group. Blood pressure responses to LBNP did not change after arm-training, leg-training or in controls ($P>0.05$). There was a small but significant increase in estimated lean leg volume after leg-training (0.1 ± 0.1 l; $P<0.05$). These results suggest that lower resting blood pressure is probably not responsible for the increased orthostatic tolerance after isometric exercise training of the legs. Rather, it is possible that the training altered some other aspect of cardiovascular control during orthostatic stress that was apparent in the changes in heart rate. Legtraining was accompanied by increases in estimated lean leg volume. The effects of isometric training on orthostatic tolerance appear to be specific to limbs that are directly involved in LBNP testing.

- **HAMILTON G F, MCDONALD C et al (1992)**The purpose of this study was to measure hand grip strength using two instruments having different physical characteristics and units of measurement to determine the reliability of repeated measures with each instrument. Additionally, validity of the sphygmomanometer for strength measurement was established through comparison with the values obtained from measurements using the research-validated Jamar dynamometer. Twenty-nine right hand dominant female college-age subjects volunteered to perform hand grip strength testing. Measurements were taken with a sphygmomanometer and a Jamar dynamometer while utilizing standardized measurement procedures. A Spearman Rho correlation coefficient test utilized in measuring within-instrument reliability showed a high correlation for each instrument at .85 for the sphygmomanometer and .82 for the Jamar dynamometer. Construct validity testing performed to determine validity of the measurements by the sphygmomanometer compared with the Jamar dynamometer produced a .75 correlation. A formula for conversion of the sphygmomanometer scores into Jamar units was developed to enhance reporting of sphygmomanometer scores utilizing the Jamar standard. The study showed that the sphygmomanometer and Jamar dynamometer exhibit good within-instrument reliability. They have stated that sphygmomanometer and hand held dynamometer having good instrument reliability.

- **SAGIN M, RATTEIN A, WATKINS et al (1992)** they have stated that changes in posture during isometric exercise modifies the cardiovascular regulation.

- **KEN TOKIAZAWA, MASAKI MIZUNO et al (2006)** they have determined that there is a difference between the cardiovascular responses to extension and flexion of arms and legs.

SECTION E: Studies related to the changes in sympathetic neural activity after isometric exercise.

- **PT BICH NGOI, S IDRISS et al (1999)** they have stated that reduced blood pressure responses to a contraction in obese patients with lower sympathetic nerve activation.

- **P.P. JONES, J.S.SKINNER et al (1996) -** Muscle sympathetic nerve activity (MSNA) has been correlated with percent body fat (%BF) in males. Because MSNA is typically lower and %BF higher in females, we tested whether this relationship could be generalized to females. Because abdominal-visceral body fat in men may be responsible for elevated sympathetic activity, we hypothesized that an estimate [waist-to-thigh ratio (W/T)] would correlate positively with MSNA in both genders and account for higher MSNA in males. It is concluded that %BF is related to MSNA in both males and females but that the regression line is shifted downward in females because of lower levels of MSNA. W/T is a better correlate of MSNA than %BF and partially explains the higher MSNA in males. These findings may be relevant to the cardiovascular and metabolic disease risk associated with abdominal obesity. They have found that gender does not influence sympathetic neural reactivity to stress in healthy males and females after isometric hand grip exercise.

- **J A TAYLOR et al (1998)** they have found that there is an increased sympathetic nerve activity during the isometric handgrip exercise at 35% of maximal voluntary contraction and reduced at 15% of maximal voluntary contraction

- **K.S GRAY, S.K WHISLER et al (1996)**Influences of gender on sympathetic nerve responses to static exercise.We compared reflex responses to static handgrip at 30% maximal voluntary contraction (MVC) in 26 untrained men (mean age 35 +/- 3 yr) and 23 untrained women (mean age 39 +/- 4 yr). Women demonstrated attenuated increases in blood pressure and muscle sympathetic nerve activity (MSNA; by microneurography) compared with men. This difference was also observed during a period of posthandgrip circulatory arrest.

31P-nuclear magnetic resonance (NMR) spectroscopy studies demonstrated attenuations in the production of diprotonated phosphate and the development of cellular acidosis in women compared with men. Subjects also performed ischemic handgrip to fatigue. During this paradigm, MSNA responses were similar in the two groups, suggesting that freely perfused conditions are necessary for the full expression of the gender effect. Finally, we examined MSNA responses to adductor pollicisexercise in 7 men (26 +/- 1 yr) and 6 women (25 +/- 2 yr). MVC values and times to fatigue were similar in the two groups (MVC: men, 4.3 +/- 0.4 kg; women, 4.0 +/- 0.3 kg; not significant. Time to fatigue: men, 209 +/- 16 s; women, 287 +/- 50 s; not significant). At periods of end exercise and post exercise circulatory arrest, MSNA responses were attenuated in the women compared with the men. We conclude that, during no ischemic static exercise, sympathetic neural outflow is less in women compared with men. This response is due to an attenuated metaboreflex in women. Finally, on the basis of the adductor pollicis experiments, this effect appears independent of muscle mass, workload, and the level of training. They have concluded that there is less sympathetic neural outflow in women than men, this response is due to the metabolic reflex of women.

- **S. M ETTINGER, J.M MCLAIN** et al (1996) they have found that sympathetic neural outflow is less than in women when compared to men after the hand grip exercise at 30% of maximal voluntary contraction.

MATERIALS AND METHODOLOGY

CHAPTER – III

III.MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN : The study was a pre-test and post-test experimental design comparative in nature.

3.2 STUDY SETTING : The study was conducted in the outpatient department of Cherraan's Institute of health sciences- department of Physiotherapy, Coimbatore.

3.3 STUDY DURATION : The study was conducted for a period of 6 months.

3.4 SAMPLE METHODS : The subjects were selected by simple random sampling methods.

3.5 SUBJECTS : Samples were randomly selected and the study population included only those who met the inclusive criteria. The basic were taken and recorded (age, height, blood pressure heart rate). Group A consists of 50 young adult individuals and group B consists of 50 young obese individuals.(N=100)

3.6 CRITERIA FOR SELECTION OF SUBJECTS

INCLUSION CRITERIA

- Both males and females
- Age group (19-35) yrs.
- BMI for normal subjects (18.5-24.9)
- BMI for obese subjects (30-34.9)
- Subjects with normal blood pressure
- Subjects willing to participate

EXCLUSION CRITERIA

- Previous history of cardiac problems, peripheral vascular disease.
- Any joint pathology in shoulder joint, elbow joint and wrist and fingers.

- Metabolic disease.
- Endocrine problem.
- Neurological problems.
- Hypertension above 140/90mmhg
- Hypotension below 90/60 mmhg

3.7 VARIABLES:

- Independent Variables

  The participants were in erect standing position and asked to perform three upper extremity isometric exercises for three minutes.

  1. It comprised of two repetitions of pushing against the wall with outstretched arms for 30 seconds each and they were instructed to exert maximal tension on the wall.
  2. Two repetitions of isometric contractions by using the hand held dynamometer, the participants were in the erect standing position with their arms were fully extended by the side of the body. They were instructed to exert maximal tension on the hand held dynamometer and hold for 30 seconds.
  3. Two repetitions of isometric contractions with the hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction. They were exerted maximal tension and hold for 30 seconds.
- Dependent Variables
  1. Heart rate
  2. Blood Pressure
  3. Rate Pressure product that is analyzed by using graph pad prism 0.5 version

3.8 MEASUREMENT TOOL & MATERIALS USED IN THE STUDY

- Weighing machine
- Digital sphygmomanometer
- Stethoscope
- Stopwatch
- Height meter scale
- Calculator

ORIENTATION OF THE SUBJECTS

Before the treatment all the subjects were explained about this study and the procedure to be applied. They were asked to inform if they feel any discomfort during the course of study. Written consent was obtained from the subjects.

3.9 PROCEDURE

The study was done on normal and obese healthy individuals to determine the effects of upper extremity isometric exercises on cardiovascular responses.

Samples were randomly selected and the study population included only those who met the inclusive criteria. After selecting the samples by random method, test procedures were explained to the subjects, written consent was collected from the subjects to participate in the study, as shown in the annexure (1). The basic were taken and recorded (age, height, blood pressure heart rate). Group A consists of 50 young adult individuals and group B consists of 50 obese individuals.

For both groups the participants were in erect standing or sitting position and asked to perform three upper extremity isometric exercises for three minutes. It comprised of two repetitions of pushing against the wall with outstretched arms for 30 seconds each and they were instructed to exert maximal tension on the wall. Two repetitions of isometric contractions by using the hand held dynamometer, the participants were in the erect standing or sitting position with their arms were fully extended in front of the body. They were instructed to exert maximal tension on the hand held dynamometer and hold for 30 seconds. Two repetitions of isometric contractions with the hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction. They were exerted maximal tension and hold for 30 seconds. During exercise the subjects were instructed to avoid Valsalva maneuver by not holding the breath and they were instructed to do rhythmic breathing. After the completion of three isometric exercise bouts immediately the post exercise cardiovascular parameters were measured and the subjects were taken rest for 10 minutes at the end of the session.

OUTCOME MEASURES

- Blood pressure
- Heart rate
- Rate pressure product

3.10MEASUREMENT PROCEDURE

DIGITAL SPHYGMOMANOMETER

HEIGHT METER SCALE

WEIGHT MACHINE

MEASURING HEIGHT

MEASURING WEIGHT

UPPER EXTREMITY ISOMETRIC EXERCISE

BY HAND HELD DYNAMOMETER

3.11 TREATMENT PROCEDURE

GROUP A (YOUNG)

- Pushing against the wall with outstretched arms.
- Using the hand held dynamometer
- The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction

a) **Pushing against the wall with outstretched arms.**

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

Pushing against the wall with outstretched arms for 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand in front of the wall in comfortable position.

Step 2: subject is instructed to push his arms with outstretched hands against the wall and the legs in walk standing position for 30 seconds.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.

Figure 1: Pushing against the wall with outstretched arms

b) Using the hand held dynamometer

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

Using the hand held dynamometer 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand or sit in comfortable position.

Step 2: subject is instructed to stand or sit in position with their arms were fully extended in front of the body. They were instructed to exert maximal tension on the hand held dynamometer and hold for 30 seconds.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.
.

Fig 2: Using the hand held dynamometer

c) **The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction**

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand or sit in comfortable position.

Step 2: subject is asked to do isometric contractions with the hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction and flexion. They were exerted maximal tension and hold for 30 seconds.

Step 3: During exercise the subjects were instructed to avoid Valsalva maneuver by not holding the breath and they were instructed to do rhythmic breathing.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.

Fig 3.1 Hands clasped together in flexion of shoulders

Fig 3.2Hands clasped together in out stretched hands at the side of the body

Fig 3.3 Hands clasped together in out stretched hands at the side of the body

After the completion of three isometric exercise bouts immediately the post exercise cardiovascular parameters were measured and the subjects were taken rest for 10 minutes at the end of the session.

GROUP B (YOUNG OBESE)

- Pushing against the wall with outstretched arms.
- Using the hand held dynamometer
- The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction

a) **Pushing against the wall with outstretched arms.**

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

Pushing against the wall with outstretched arms for 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand in front of the wall in comfortable position.

Step 2: subject is instructed to push his arms with outstretched hands against the wall and the legs in walk standing position for 30 seconds.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.

Fig4: Pushing against the wall with outstretched arms

b) Using the hand held dynamometer

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

Using the hand held dynamometer 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand or sit in comfortable position.

Step 2: subject is instructed to stand or sit in position with their arms were fully extended in front of the body. They were instructed to exert maximal tension on the hand held dynamometer and hold for 30 seconds.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.

.

Fig 5: Using the hand held dynamometer

c) **The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction**

Patient position:

Sitting or Standing.

Therapist position:

Walk standing position.

Procedure:

The hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction 30 seconds consists of 2 repetitions:

Step 1:Subject was instructed to stand or sit in comfortable position.

Step 2: subject is asked to do isometric contractions with the hands clasped together and bought to the manubriosternal level of the shoulders in 80-90 degree of abduction and flexion. They were exerted maximal tension and hold for 30 seconds.

Step 3: During exercise the subjects were instructed to avoid Valsalva maneuver by not holding the breath and they were instructed to do rhythmic breathing.

Step 3: This training session consists of 2 repetitions for 1 minute, every day for six months.

Fig 6.1 Hands clasped together in flexion of shoulders

Fig 6.2Hands clasped together in out stretched hands at the side of the body

Fig 6.3 Hands clasped together in out stretched hands at the side of the body

After the completion of three isometric exercise bouts immediately the post exercise cardiovascular parameters were measured and the subjects were taken rest for 10 minutes at the end of the session.

TREATMENT DURATION

3 minutes per session.

COLLECTION OF DATA

The selected 100 subjects were divided into 2 groups

1. **GROUP A (young)**
2. **GROUP B (young obese)**

Both the experimental groups were given treatment for continues 6 months. Before and after the completion of 6 month treatment, blood pressure(systolic and diastolic), heart rate and rate pressure product was measured by Digital sphygmomanometer and scale was recorded.

DATA ANALYSIS

CHAPTER IV

DATA ANALYSIS

TECHNIQUE OF DATA ANALYSIS:

The Blood Pressure and heart rate was calculated after the upper extremity Isometric exercise by using the pre-test and post- test taken before and after treatment. The data obtained are analyzed using paired t-test.

MEAN

$$\bar{d} = \sum \frac{d}{n}$$

STANDARD DEVIATION

$$\text{SD} = \sqrt{\sum \frac{(d-\bar{d})^2}{n-1}}$$

PAIRED "t" TEST

$$\text{t} = \frac{\bar{d}\sqrt{n}}{S.D}$$

Where,

$\bar{d}$ = calculated mean difference pre-test and post-test.

n = sample size.

SD = standard deviation.

d = difference between pre and post-test.

UNPAIRED “t” TEST

The unpaired t -test was used to compare the statistical significant difference between group A and group B

FORMULA

$$s = \sqrt{\frac{(n_1-1){s_1}^2+(n_2-1){s_2}^2}{n_1+n_2-2}}$$

$$t = \frac{\bar{x}_1-\bar{x}_2}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

n_1 = total number of subject in group A.

n_2 = total number of subject in group B.

x_1 = difference between pre-test & post-test values of group A.

x_2 =difference between pre-test & post-test values of group B.

$\bar{x}_1$ = mean difference between pre-test & post-test value of group A

$\bar{x}_2$ = mean difference between pre-test & post-test value of group B.

STATISTICAL ANALYSIS

Statistical methods: The dependent variables are Heart rate, Blood pressure, rate pressure product that's analyzed by using Graph pad prism 0.5 version.

DATA ANALYSIS

Table: 1

COMPARISON BETWEEN GROUP A AND GROUP B PRE TEST IN HEART RATE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	**98**	**1.012**	**1.661**	**N/S**

In this table, the calculated value is (1.012) less than the table value (1.661). Hence no significant difference in group A and group B pretest in heart rate.

GRAPH 1

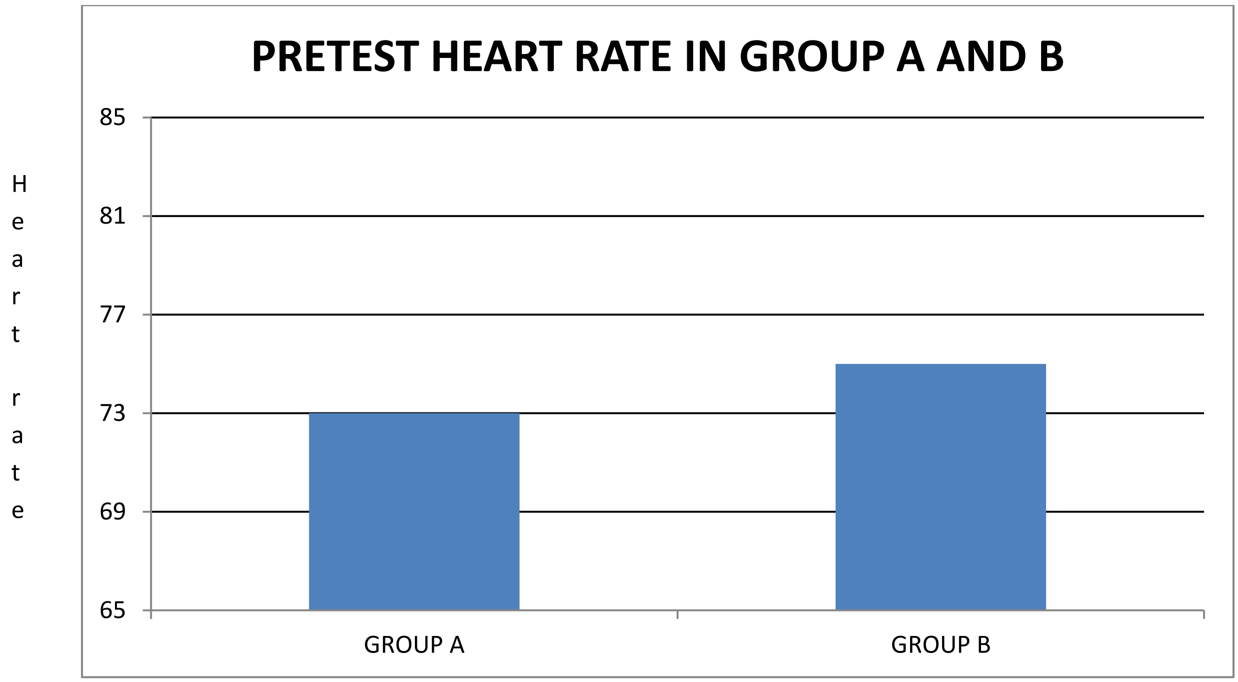

PRETEST HEART RATE IN GROUP A AND B
Heart rate
85
81
77
73
69
65
GROUP A
GROUP B

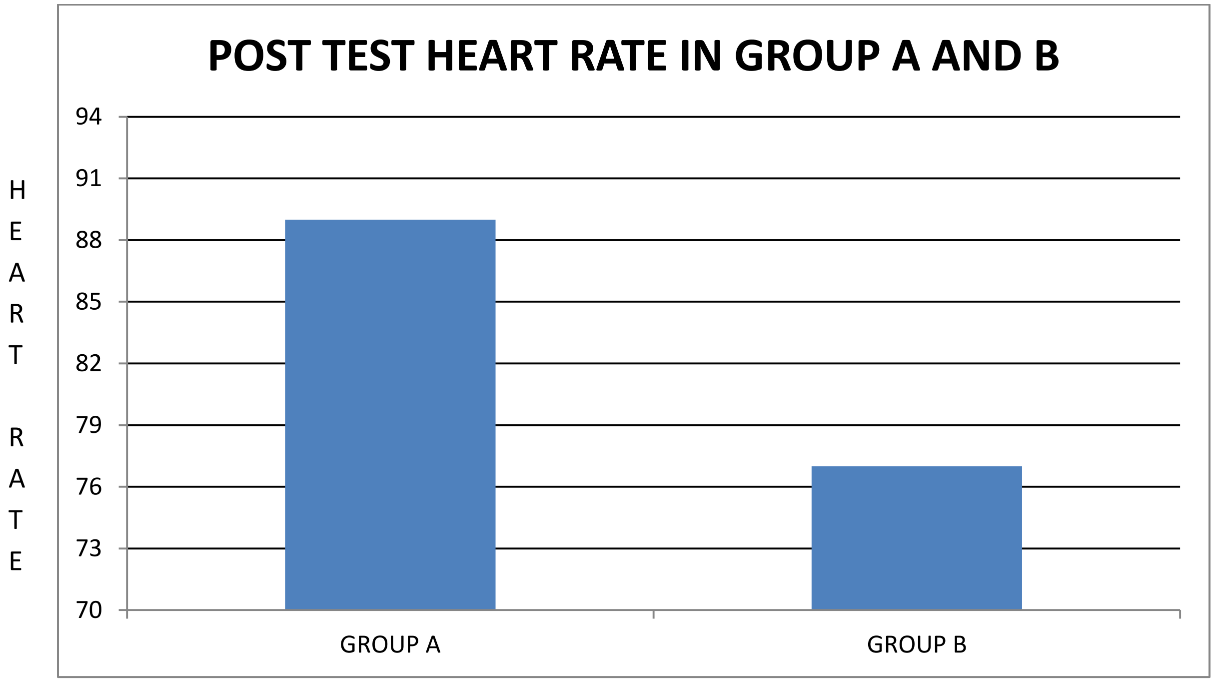
Table: 2

COMPARISON BETWEEN GROUP A AND GROUP B POST TEST IN HEART RATE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	4.391	1.661	SIGNIFICANT

In this table, the calculated value (4.391) is greater than the table value (1.661). Hence there is a significant difference between group A and group B posttest in heart rate.

GRAPH 2:



POST TEST HEART RATE IN GROUP A AND B
HEART RATE
94
91
88
85
82
79
76
73
70
GROUP A
GROUP B

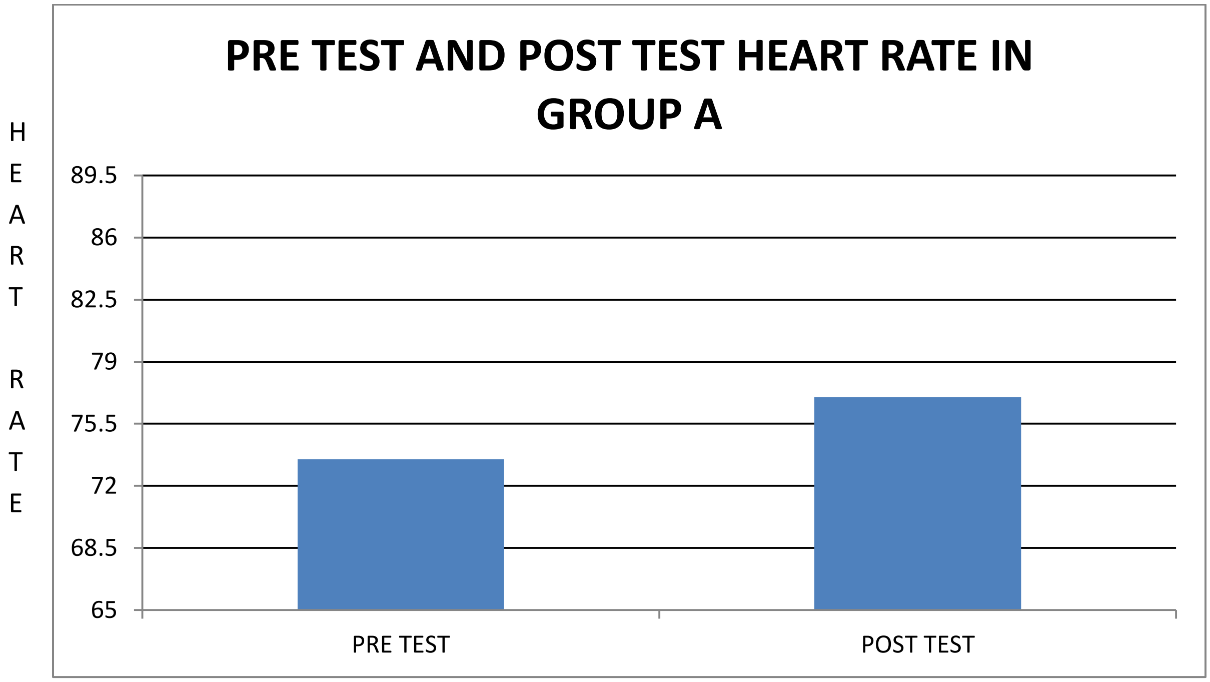
Table: 3

COMPARISON OF PRE TEST AND POST TEST HEART RATE IN GROUP A

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	8.410	1.677	SIGNIFICANT

In this table, the calculated value (8.410) is greater than the table value (1.667). Hence there is a significant difference between Group A pre test and post test in Heart rate.

GRAPH: 3



PRE TEST AND POST TEST HEART RATE IN GROUP A
HEART RATE
89.5
86
82.5
79
75.5
72
68.5
65
PRE TEST
POST TEST

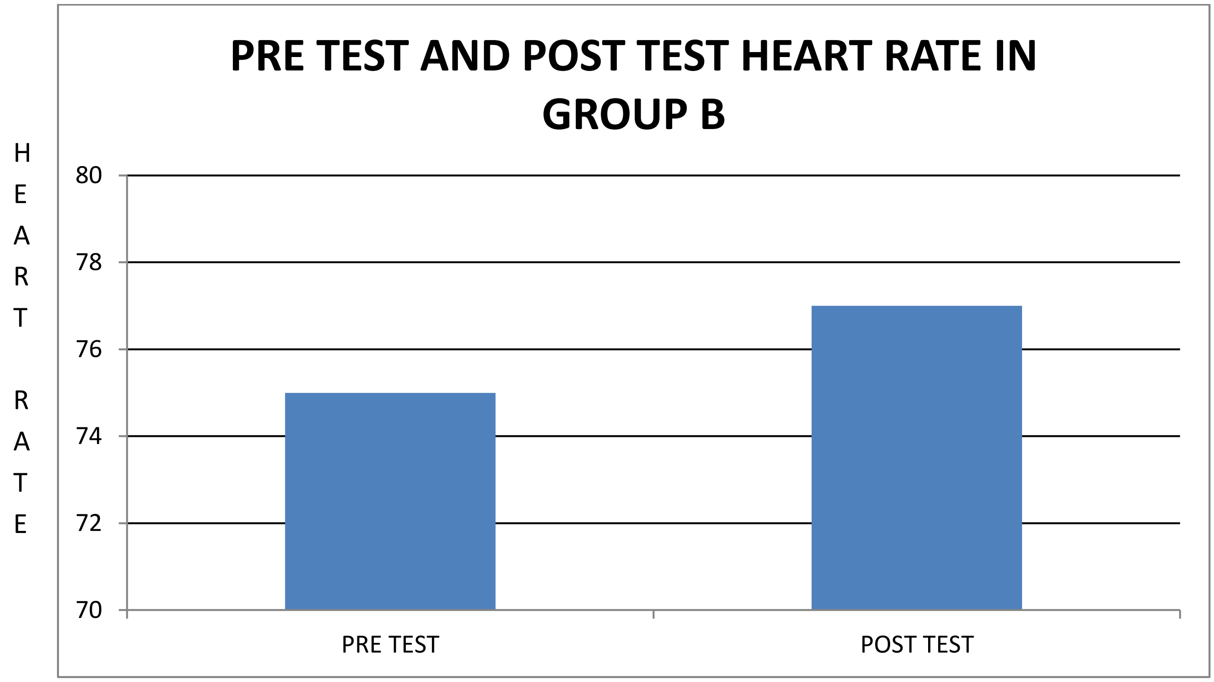
Table: 4

COMPARISON OF GROUP B PRE TEST AND POST TEST IN HEART RATE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	4.157	1.677	SIGNIFICANT

In this table, the calculated value (4.157) is greater than the table value (1.677). Hence there is a significant difference between Group B pre test and post test in Heart rate.

GRAPH: 4



PRE TEST AND POST TEST HEART RATE IN GROUP B
HEART RATE
80
78
76
74
72
70
PRE TEST
POST TEST

Table: 5

COMPARISON OF GROUP A PRE TEST AND POST TEST IN SYSTOLIC PRESSURE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	7.950	1.677	SIGNIFICANT

In this table, the calculated value (7.950) is greater than the table value (1.677). Hence there is a significant difference between Group A pre test and post test in systolic blood pressure.

GRAPH: 5

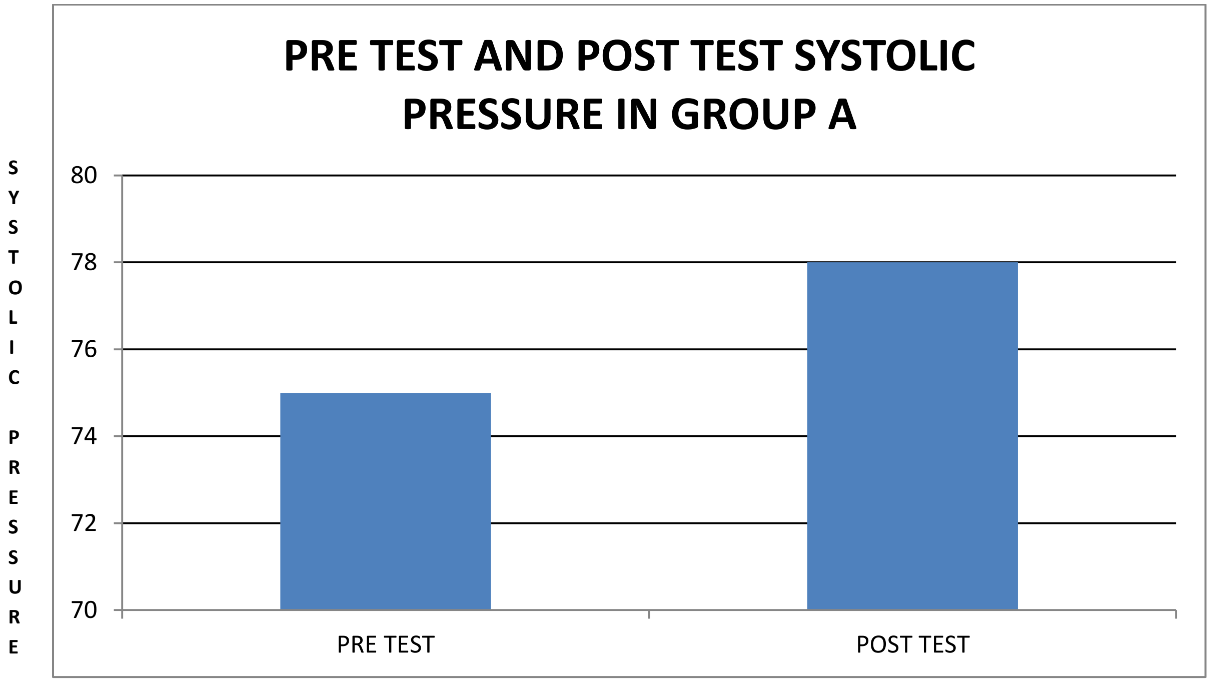

PRE TEST AND POST TEST SYSTOLIC PRESSURE IN GROUP A
SYSTOLIC PRESSURE
80
78
76
74
72
70
PRE TEST
POST TEST

Table: 6

COMPARISON OF GROUP B PRE TEST AND POST TEST IN SYSTOLIC PRESSURE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	4.607	1.677	SIGNIFICANT

In this table, the calculated value (4.607) is greater than the table value (1.677). Hence there is a significant difference between pre test and post test in systolic blood pressure in Group B.

GRAPH: 6

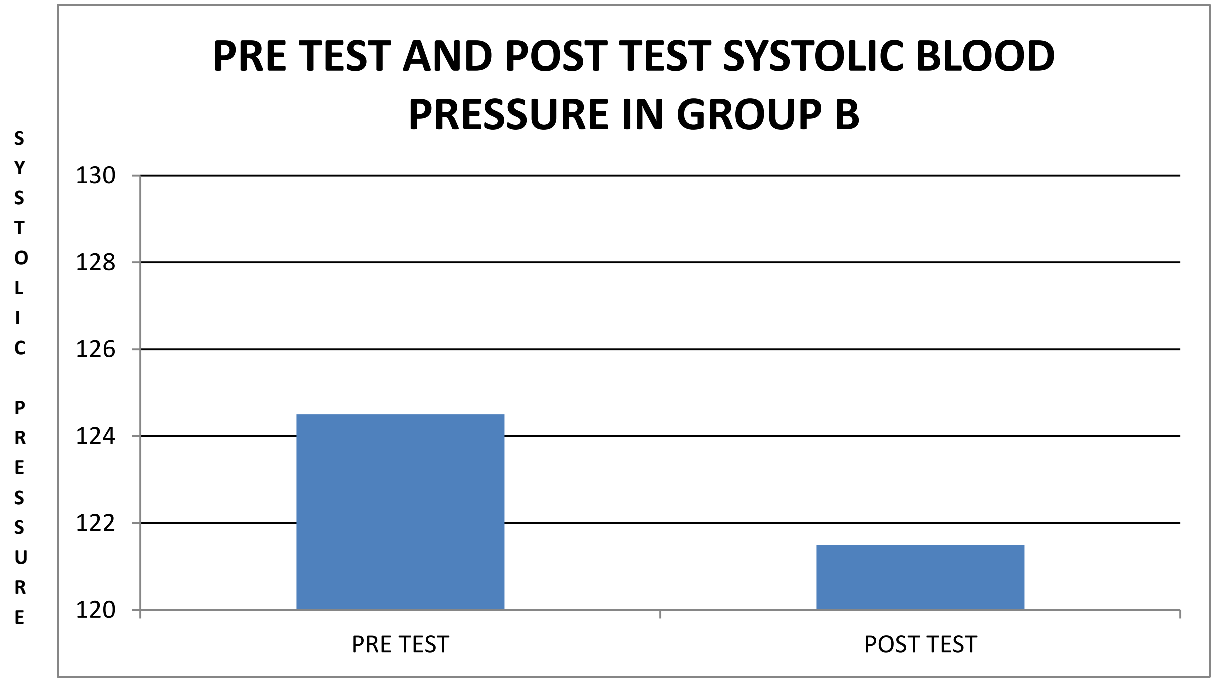

PRE TEST AND POST TEST SYSTOLIC BLOOD PRESSURE IN GROUP B
SYSTOLIC PRESSURE
130
128
126
124
122
120
PRE TEST
POST TEST

Table: 7

COMPARISON BETWEEN PRE TEST SYSTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	0.8670	1.661	N/S

In this table, the calculated value (0.8670) is lesser than the table value (1.661). Hence there is no significant difference in pre test systolic blood pressure in Group A and Group B.

GRAPH: 7

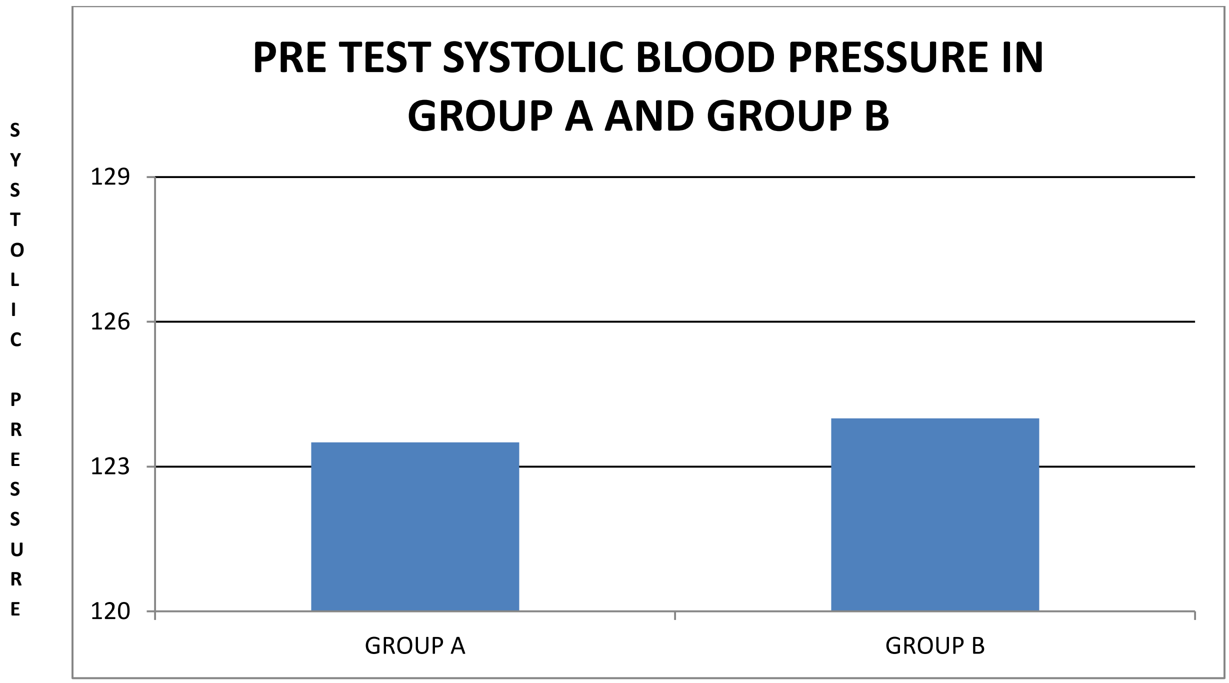

PRE TEST SYSTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B
SYSTOLIC PRESSURE
129
126
123
120
GROUP A
GROUP B

Table: 8

COMPARISON BETWEEN POST TEST SYSTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	3.717	1.661	SIGNIFICANT

In this table, the calculated value (3.717) is greater than the table value (1.661). Hence there is a significant difference in post test systolic blood pressure in Group A and Group B.

GRAPH: 8

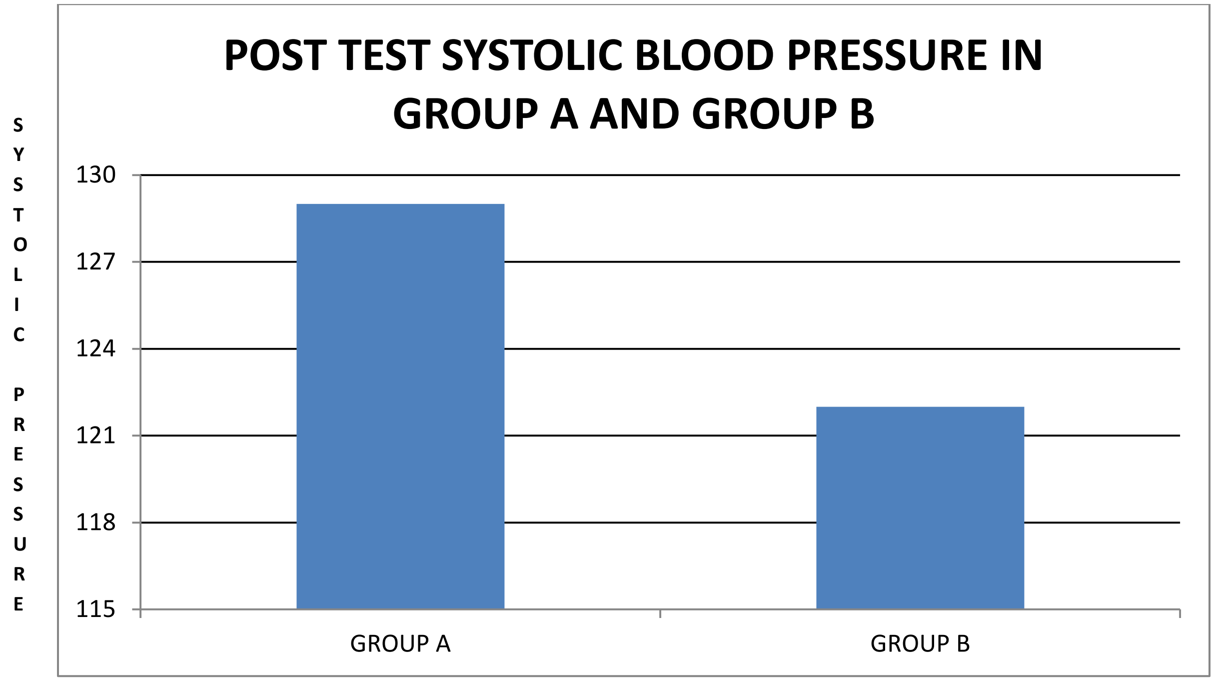

POST TEST SYSTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B
SYSTOLIC PRESSURE
130
127
124
121
118
115
GROUP A
GROUP B

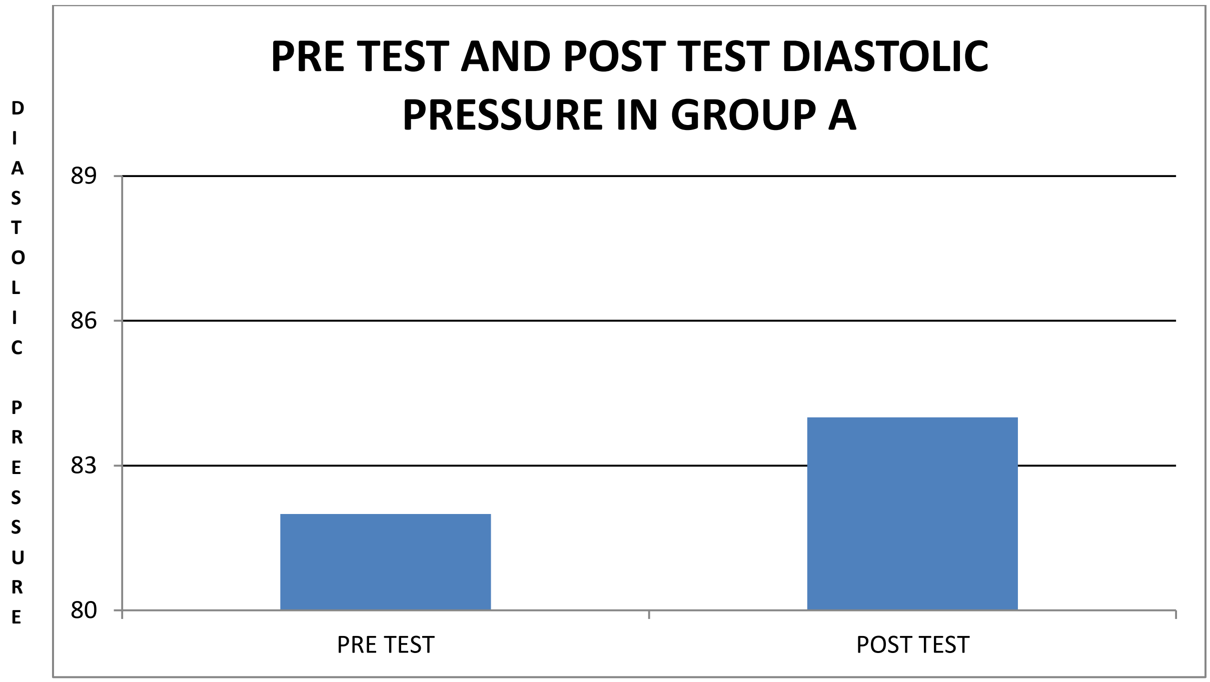
Table: 9

COMPARISON BETWEEN PRE TEST AND POST TEST DIASTOLIC PRESSURE IN GROUP A

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	1.244	1.677	N/S

In this table, the calculated value (1.244) is lesser than the table value (1.677). Hence there is no significant difference in Group A pre and post test diastolic blood pressure.

GRAPH: 9



PRE TEST AND POST TEST DIASTOLIC PRESSURE IN GROUP A
DIASTOLIC PRESSURE
89
86
83
80
PRE TEST
POST TEST

Table: 10

COMPARISON OF GROUP B PRE TEST AND POST TEST IN DIASTOLIC BLOOD PRESSURE

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	1.258	1.677	N/S

In this table, the calculated value (1.258) is lesser than the table value (1.677). Hence there is no significant difference in Group B pre and post test diastolic blood pressure.

GRAPH: 10

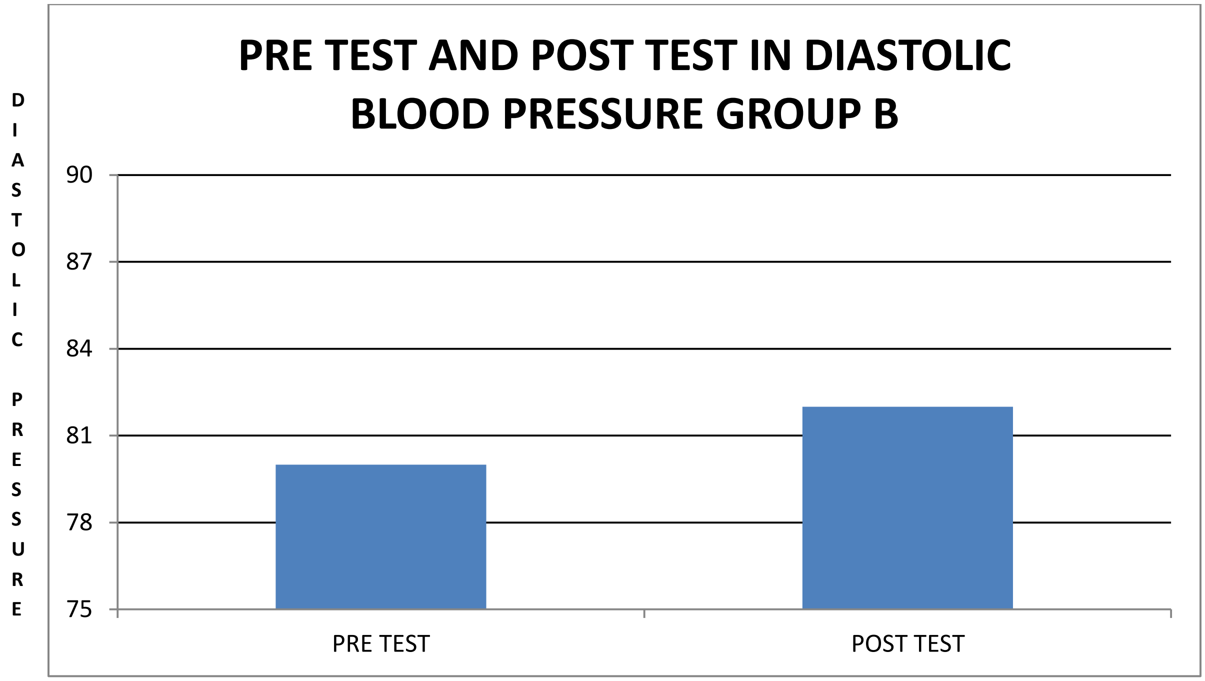

PRE TEST AND POST TEST IN DIASTOLIC BLOOD PRESSURE GROUP B
DIASTOLIC PRESSURE
90
87
84
81
78
75
PRE TEST
POST TEST

Table: 11

COMPARISON OF PRE TEST DIASTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	1.346	1.661	N/S

In this table, the calculated value (1.346) is lesser than the table value (1.661). Hence there is no significant difference between pretest diastolic blood pressure in group A and group B.

GRAPH: 11

PRE TEST DIASTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

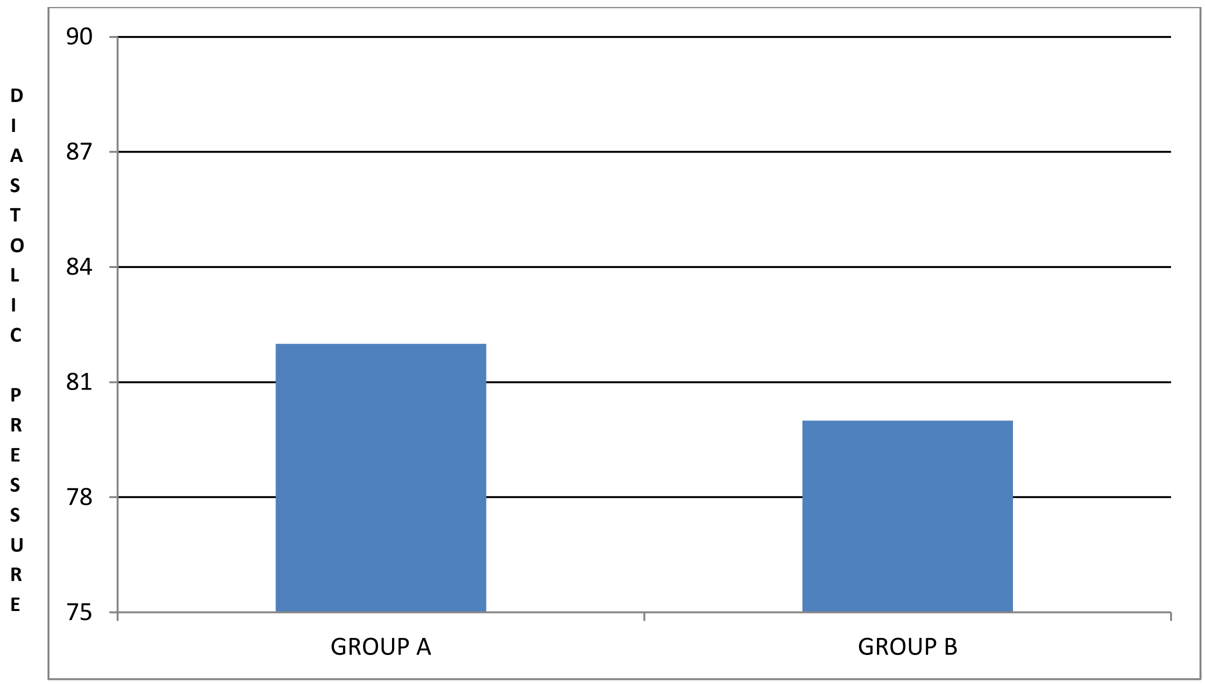


Table: 12

COMPARISON OF POST TEST DIASTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	1.331	1.661	N/S

In this table, the calculated value (1.331) is lesser than the table value (1.661). Hence there is no significant difference between posttest diastolic blood pressure in group A and group B.

GRAPH: 12

POST TEST DIASTOLIC BLOOD PRESSURE IN GROUP A AND GROUP B

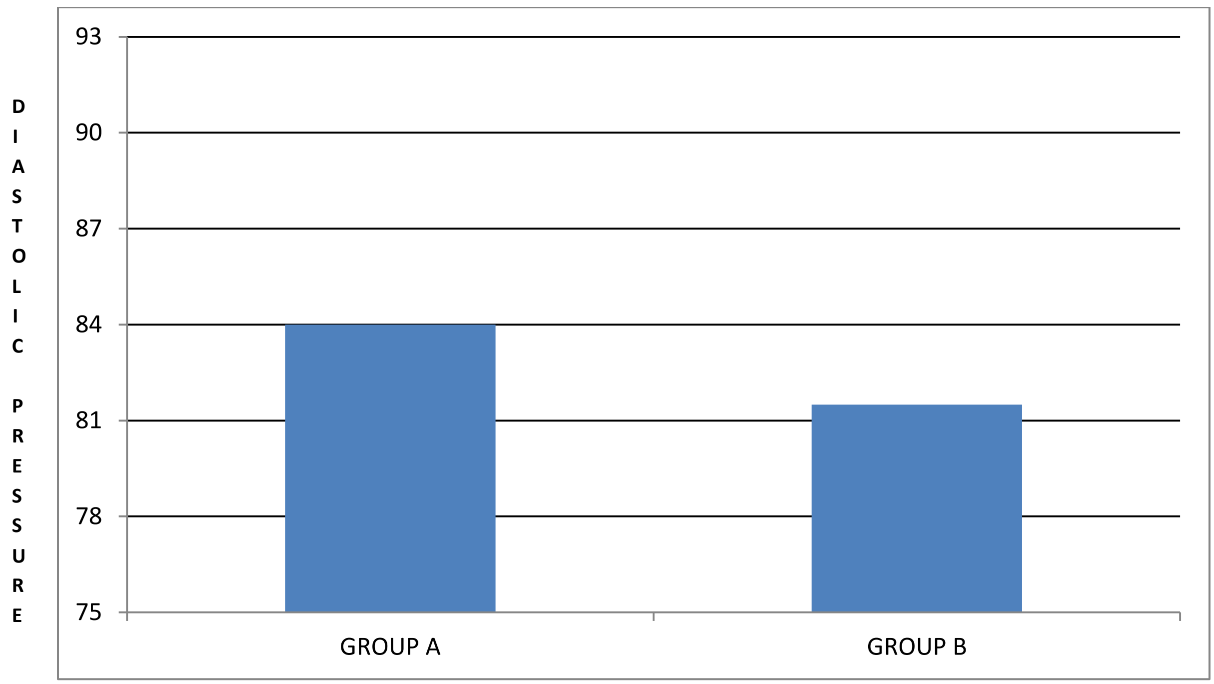


Table: 13

COMPARISON OF PRE TEST AND POST TEST RATE PRESSURE PRODUCT IN GROUP A

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	9.513	1.677	SIGNIFICANT

In this table, the calculated value (9.513) is greater than the table value (1.677). Hence there is a significant difference between pretest and post test rate pressure product in Group A.

GRAPH: 13

PRE TEST AND POST TEST RATE PRESSURE PRODUCT IN GROUP A

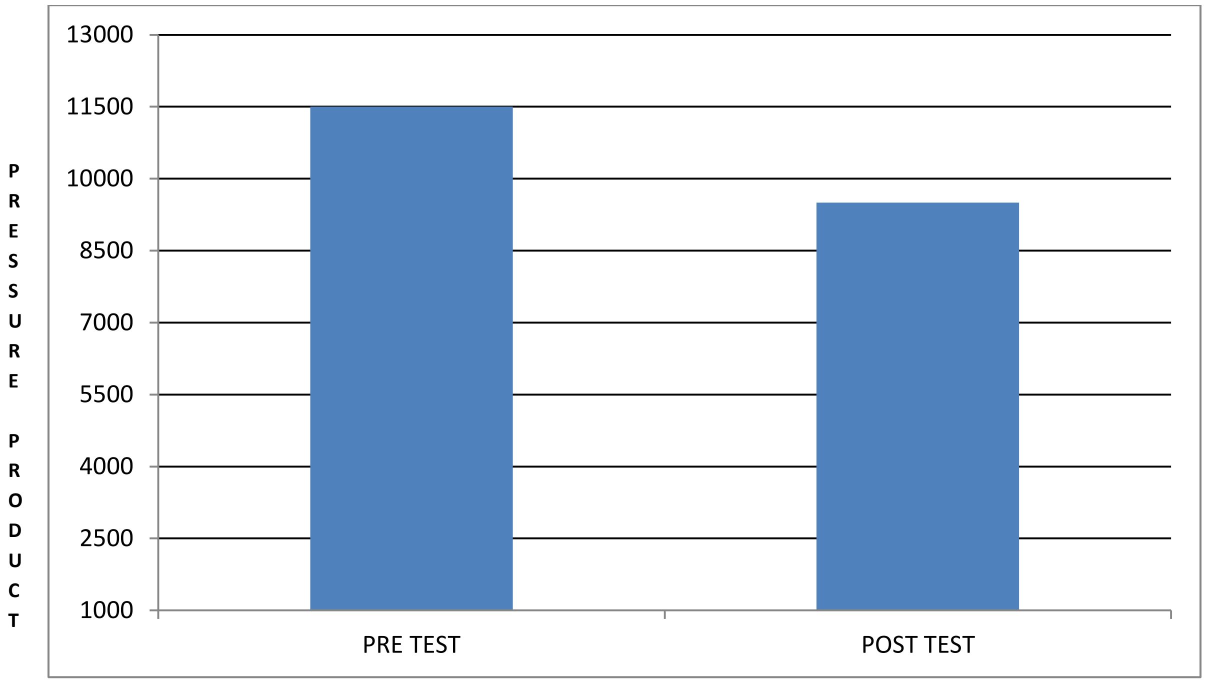


Table: 14

COMPARISON OF PRE TEST AND POST TEST RATE PRESSURE PRODUCT IN GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	49	1.175	1.677	N/S

In this table, the calculated value (1.346) is lesser than the table value (1.677). Hence there is no significant difference between pretest and post test rate pressure product in group B.

GRAPH: 14

PRE TEST AND POST TEST RATE PRESSURE PRODUCT IN GROUP B

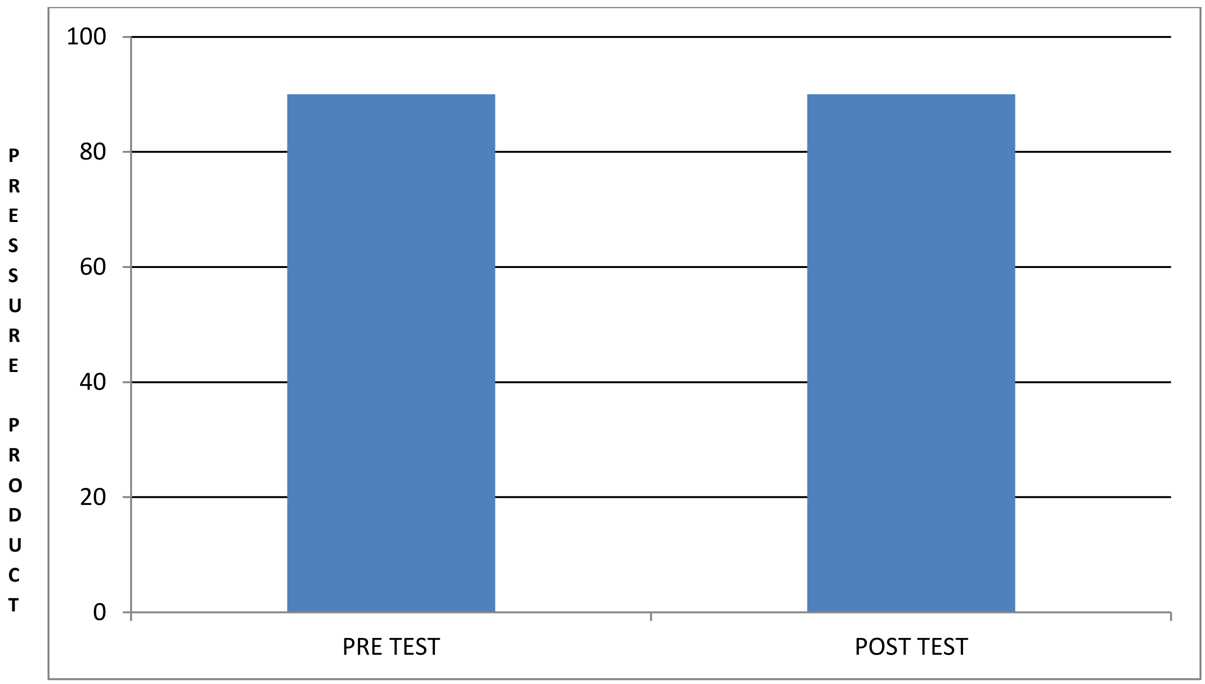


Table: 15

COMPARISON OF PRE TEST RATE PRESSURE PRODUCT IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	1.323	1.661	N/S

In this table, the calculated value (1.323) is lesser than the table value (1.661). Hence there is no significant difference between pretest rate pressure product in group A and group B.

GRAPH: 15

PRE TEST RATE PRESSURE PRODUCT IN GROUP A AND GROUP B

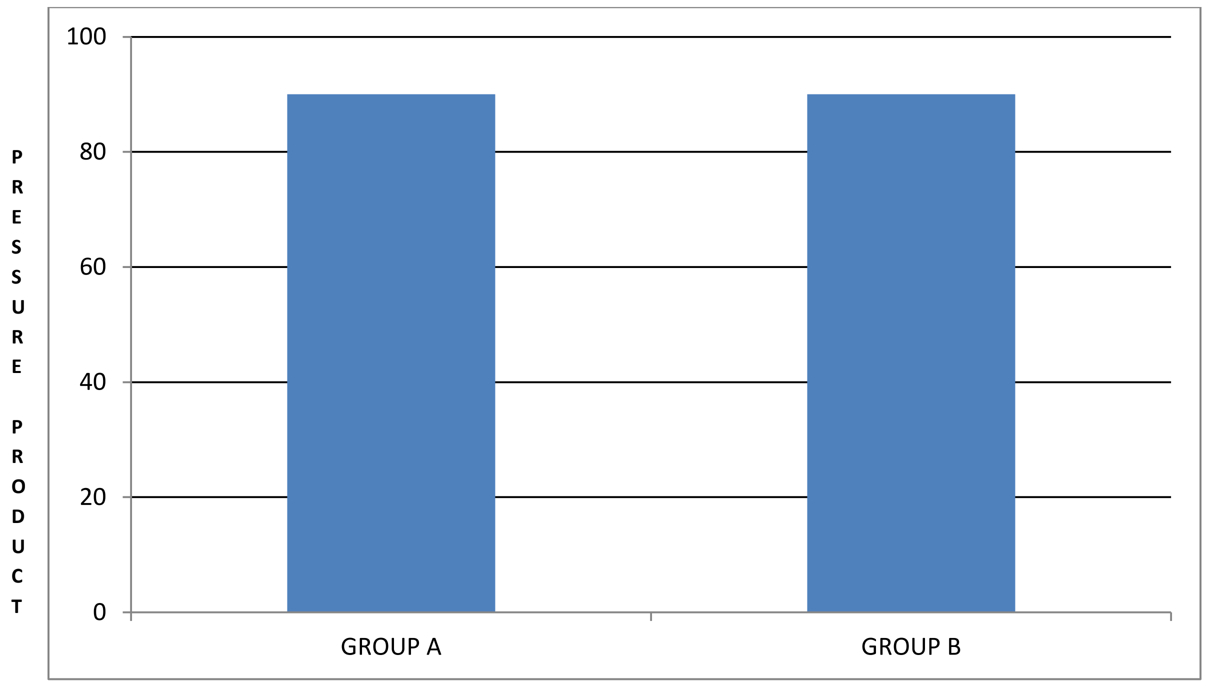


Table: 16

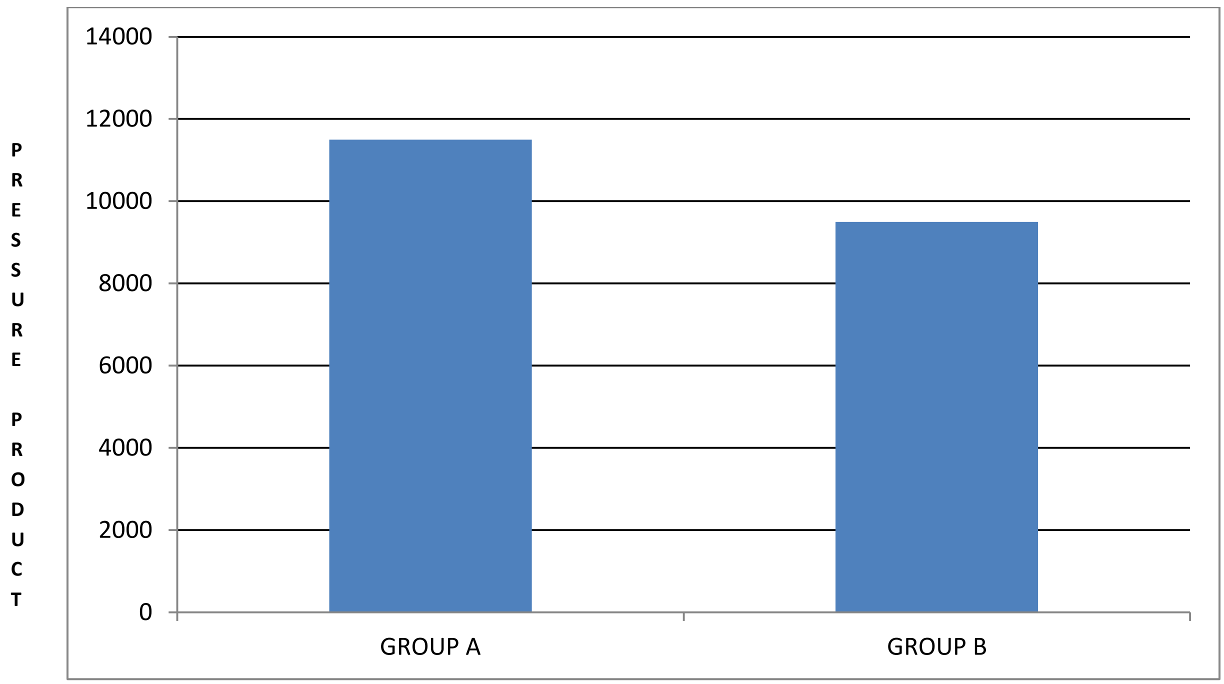
COMPARISON OF POST TEST RATE PRESSURE PRODUCT IN GROUP A AND GROUP B

S.NO	DEGREE OF FREEDOM	CALCULATED VALUE	TABLE VALUE	SIGNIFICANCE <0.05% LEVEL
1	98	5.588	1.661	SIGNIFICANT

In this table, the calculated value (5.588) is greater than the table value (1.661). Hence there is a significant difference between posttest rate pressure product in group A and group B.

GRAPH: 16

POST TEST RATE PRESSURE PRODUCT IN GROUP A AND GROUP B



RESULTS

CHAPTER-V

RESULTS

The purpose of the study was to find out the "Difference between the effects of upper extremity isometric exercises on cardiovascular responses among normal and obese individuals"

From tables 1 to 16 the following inferences are made,

Table 1: Analyzing the pre test values of heart rate in both Group A and Group B, there is no significant differences with calculated value of (1.012) and Table value (1.661).

Table 2: Analyzing the post test values of heart rate in both Group A and Group B, there is an significant differences with calculated value of (4.931) and Table value (1.661).

Table 3: Analyzing the pre test and post test values of heart rate in Group A, there is an significant differences with calculated value of (8.410) and Table value (1.677).

Table 4: Analyzing the pre test and post test values of heart rate in Group B, there is an significant differences with calculated value of (4.157) and Table value (1.677).

Table 5: Analyzing the pre test and post test systolic blood pressure in Group A, there is an significant differences with calculated value of (7.950) and Table value (1.677).

Table 6: Analyzing the pre test and post test systolic blood pressure in Group B, there is an significant differences with calculated value of (4.607) and Table value (1.677).

Table 7: Analyzing the pre test values of systolic blood pressure in both Group A and Group B, there is no significant differences with calculated value of (0.8670) and Table value (1.661).

Table 8: Analyzing the post test values of systolic blood pressure in both Group A and Group B, there is an significant differences with calculated value of (3.717) and Table value (1.661).

Table 9: Analyzing the pre test and post test values of diastolic blood pressure in Group A, there is no significant differences with calculated value of (1.244) and Table value (1.677).

Table 10: Analyzing the pre test and post test values of diastolic blood pressure in Group B, there is no significant differences with calculated value of (1.258) and Table value (1.677).

Table 11: Analyzing the pre test values of diastolic blood pressure in Group A and Group B, there is no significant differences with calculated value of (1.346) and Table value (1.661).

Table 12: Analyzing the post test values of diastolic blood pressure in Group A and Group B, there is no significant differences with calculated value of (1.331) and Table value (1.661).

Table 13: Analyzing the pre test and post test rate pressure product in Group A, there is a significant differences with calculated value of (9.513) and Table value (1.677).

Table 14: Analyzing the pre test and post test rate pressure product in Group B, there is no significant differences with calculated value of (1.175) and Table value (1.677).

Table 15: Analyzing the pre test rate pressure product in Group A and Group B, there is no significant differences with calculated value of (1.323) and Table value (1.661).

Table 16: Analyzing the post test rate pressure product in Group A and Group B, there is a significant differences with calculated value of (5.588) and Table value (1.661).

Hence, by comparing the values of heart rate, blood pressure and rate pressure product in Group A and Group B, shows significant differences in heart rate, systolic blood pressure and rate pressure product. Thus, from the above results the Null hypothesis is rejected.

DISCUSSION

CHAPTER – VI

DISCUSSION

The result of this study indicated that there is a difference in cardiovascular responses after upper extremity isometric exercise in normal and obese individuals between Group A and Group B without causing any undesirable effect in subjects.

This study revealed that post-test measures of the heart rate increased about 90% of Group A but 20% of decreased heart rate in Group B. J.H Mitchell and F.C Payne, proved that the heart rate increased momentarily with onset of a contraction during upper extremity isometric exercise [4]. P Valensi and PT Bichngoe, studied that the obese patients having decreased total peripheral vascular resistance and due to the alteration in the vagal sympathetic activity there is a impaired heart rate after upper extremity isometric exercises.

This study revealed that post measure of the systolic blood pressure increased 90% of Group A but only 60% of systolic blood pressure increased in Group B. S Idriss and J Paries stated that blood pressure responses to an isometric contraction is impaired in obese patients due to lower sympathetic activation[11].

This study revealed that post measure of the rate pressure product increased in Group A then Group B, due to increase in Heart rate and systolic blood pressure in Group A. Rate pressure product is an index measuring myocardial oxygen consumption.

This study revealed that Group B there is reduction of systolic blood pressure about 40% after the upper extremity isometric exercise. B Lormeau and J R atali stated that there is an impaired vagal reflex and metabolic reflex in obese patients.

This study reveals that the systolic blood pressure is decreased about 20% higher in female obese than male obese is due to the sympathetic neural adjustments reflected by cardiovascular and humoral responses by Jones et al.

Based on the statistical analysis, there was a significant difference in post values of heart rate, blood pressure and rate pressure product.

CONCLUSION

CHAPTER – VII

CONCLUSION

The results of this study thus concluded that there are significant differences in cardiovascular responses in normal and obese individuals, after an upper extremity isometric exercise.

Thus, this study will be useful for prescribing exercise for obese to improve the cardiovascular fitness

LIMITATIONS &RECOMMENDATION

CHAPTER – VIII

LIMITATIONS & RECOMMENDATION

LIMITATIONS OF THE STUDY

- The sample size is small.
- Prior autonomic test has to be taken before the exercise for obese.
- We were included both sex.

RECOMMENDATIONS:

- Large sample size including both male and female subjects can be done.
- Have to be study on different population, with different race.
- Should be done among the gender.

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CHAPTER – IX

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ANNEXURE

CHAPTER – X

ANNEXURE I

PHYSIOTHERAPY ASSESSMENT

Subjective assessment

- Name:
- Age:
- Sex:
- Occupation:
- Chief complaints:
- History
- Past medical history:
- Present medical history:
- Surgical history:
- Family history:
- History of allergy:
- Social history:
- Vital Signs
  - Blood Pressure
  - Heart Rate
  - Respiratory Rate
  - Pulse Rate
  - Temperature

Objective Assessment

On Observation

- Evaluation of general appearance
  - Consciousness
  - Body built
  - Posture
- Evaluation of extremity
  - Painful swollen joints
  - Tremor
  - Oedema
  - Clubbing
- Evaluation of head and neck
  - Facial appearance
  - Colour of mucous membrane
  - Facial colour
  - Size of neck veins
- External appearance
- Evaluation of unmoving chest
- Evaluation of moving chest
- Inspiratory and Expiratory ratio
- Evaluation of speech
- Cardinal symptoms

- Sputum
- Wheeze
- Dyspnoea

On Palpation

- Symmetry of chest
- Evaluation of chest motion
- Depth of excursion
- Fermitus

On percussion

On auscultation

Other areas for evaluation

- Shoulder
- Trunk
- Muscle strength
- Functional independence
- General endurance

ANNEXURE: II

NAME OF THE PARTICIPANTS:

AGE: **SEX:**

OCCUPATION:

HEIGHT:

WEIGHT:

BMI:

PRE TEST VALUES:

HEART RATE	BLOOD PRESSURE	RATE PRESSURE PRODUCT

POST TEST VALUES:

HEART RATE	BLOOD PRESSURE	RATE PRESSURE PRODUCT

ANNEXURE III

YOUNG ADULTS

S.no	AGE	SEX	OCCUPATION	HEIGHT	WEIGHT	BMI	PRE TEST VALUES			POST TEST VALUES		
							HR	BP	RBP	HR	BP	RBP
1	26yrs	F	Doctor	153cm	52.5kg	22.42	90bpm	113/88	10170	71bpm	120/76	8520
2	35yrs	F	House wife	162cm	62kg	23.624	65bpm	95/80	6175	105bpm	106/93	11130
3	21yrs	F	Student	163cm	66kg	24.9	93bpm	118/80	10974	94bpm	125/64	11750
4	23yrs	M	Student	160cm	60kg	23.49	81bpm	129/62	10449	89bpm	138/69	12282
5	23yrs	F	Student	163cm	61kg	23.35	100bpm	105/74	10500	101bpm	111/73	11121
6	18yrs	F	Student	154cm	58kg	24.456	76bpm	112/72	8512	79bpm	119/60	9401
7	18yrs	F	Student	158cm	53.5kg	22.1	91bpm	118/104	10738	100bpm	124/74	12400
8	18yrs	F	Student	162cm	62kg	23.3	83bpm	128/90	10624	88bpm	141/80	12408
9	20yrs	M	Student	176cm	60kg	19.3	60bpm	118/65	7080	70bpm	119/60	8190
10	18yrs	F	Student	154cm	49.5kg	20.87	70bpm	123/87	8610	76bpm	129/75	9804
11	21yrs	M	Student	152cm	53.5kg	23.15	67bpm	119/75	7973	76bpm	125/70	9500
12	19yrs	M	Student	157cm	54kg	21.9	75bpm	115/87	8625	86bpm	119/83	10234
13	19yrs	F	Student	147cm	48kg	22.2	66bpm	118/70	7722	79bpm	104/90	8216
14	35yrs	M	Tutor	155cm	55kg	22.89	76bpm	136/89	10336	86bpm	139/80	11954
15	32yrs	F	Teacher	153cm	54kg	23.06	70bpm	129/87	9030	80bpm	125/98	10000
16	35yrs	M	Tutor	156cm	58kg	23.83	76bpm	132/90	10032	96bpm	136/95	13056
17	30yrs	F	Tutor	153cm	54kg	23.06	68bpm	118/86	8024	73bpm	126/90	9198
18	20yrs	M	Student	160cm	63kg	24.6	65bpm	117/68	7605	68bpm	125/80	8500
19	21yrs	F	Student	156cm	58kg	23.83	68bpm	120/80	8160	71bpm	119/90	8449
20	30yrs	F	Tutor	155cm	55kg	22.89	75 bpm	128/75	9600	79bpm	130/80	10270
21	21yrs	F	Student	160cm	62.5kg	24.41	65 bpm	115/75	7475	70bpm	120/85	8400
22	27yrs	M	Tutor	154cm	56.2kg	23.69	72 bpm	130/90	9360	86bpm	138/90	11868
23	20yrs	M	Student	160cm	61.5kg	24.02	76 bpm	125/90	9500	80bpm	130/80	10400

24	35yrs	F	Worker	155cm	56kg	23.3	68 bpm	130/89	8840	76bpm	123/90	9348
25	32yrs	F	Worker	153cm	55.5kg	23.7	80 bpm	135/80	10800	85bpm	133/85	11305
26	20yrs	M	Student	156cm	57.5kg	23.62	65 bpm	120/85	7800	70bpm	127/90	8890
27	25yrs	F	Clerk	161cm	62.5kg	24.11	70 bpm	129/90	9030	84bpm	130/85	10920
28	28yrs	M	Teacher	156cm	54.5kg	22.39	68 bpm	130/86	8840	110bpm	136/78	14960
29	35yrs	M	Tutor	158cm	59kg	23.63	72 bpm	132/85	9504	99bpm	135/90	13365
30	33yrs	M	Tutor	165cm	65kg	23.87	80 bpm	130/90	10400	89bpm	139/86	12371
31	21yrs	M	Student	152cm	50.5kg	21.85	65 bpm	118/85	7670	80bpm	125/80	10000
32	18yrs	F	Student	159cm	61kg	24.12	70 bpm	125/80	8750	110bpm	128/90	14080
33	19yrs	F	Student	153cm	56kg	23.92	65bpm	115/80	7475	70bpm	120/90	8400
34	30yrs	M	Professor	165cm	60kg	22.03	78bpm	129/90	10062	90bpm	135/87	11745
35	21yrs	M	Student	150cm	53kg	23.55	70bpm	124/80	8680	100bpm	138/90	13800
36	19yrs	M	Student	159cm	58kg	23.13	62bpm	115/76	7130	89bpm	125/80	11125
37	34yrs	F	Tutor	152cm	54.5kg	23.5	68bpm	135/78	9180	89bpm	138/80	12282
38	31yrs	F	Teacher	157cm	50kg	20.28	65bpm	130/75	8450	90bpm	140/86	12600
39	20yrs	F	Student	154cm	57kg	24.03	63bpm	117/78	7371	75bpm	128/85	9600
40	21yrs	F	Student	156cm	50kg	20.54	68bpm	123/80	8364	95bpm	130/90	12350
41	30yrs	M	Tutor	165cm	59kg	21.67	75bpm	135/86	10125	112bpm	138/95	15456
42	23yrs	M	Student	158cm	52kg	20.82	70bpm	123/85	8610	108bpm	130/90	14040
43	34yrs	M	Tutor	155cm	49.5kg	20.6	76bpm	129/89	9804	112bpm	135/95	15120
44	32yrs	M	Operator	156cm	57kg	23.42	80bpm	134/86	10720	116bpm	140/90	16240
45	31yrs	M	Tutor	159cm	61kg	24.12	72bpm	129/90	9288	90bpm	136/86	12240
46	29yrs	M	Tutor	165cm	60kg	22.03	67bpm	121/80	8107	90bpm	129/89	11610
47	33yrs	M	Teacher	153cm	56.5kg	24.13	80bpm	119/85	9520	111bpm	130/90	14430
48	32yrs	F	Clerk	162cm	55kg	20.95	75bpm	125/80	9375	115bpm	132/89	13115
49	20yrs	F	Student	154cm	56.5kg	23.82	72bpm	114/80	8208	99bpm	129/85	12771
50	21yrs	M	Student	157cm	61kg	24.74	80bpm	125/80	10000	115bpm	132/86	15180

ANNEXURE IV (YOUNG OBESE)

S.no	AGE	SEX	OCCUPATION	HEIGHT	WEIGHT	BMI	PRE TEST VALUES			POST TEST VALUES		
1	25yrs	f	Clerk	150cm	69.5	30.88	68	129/85	8772	76	131/80	9956
2	26yrs	f	Assistant	173cm	99	33.07	75	117/70	8775	90	109/77	9810
3	19yrs	m	Student	159cm	86.7	34.29	70	125/86	8750	68	115/95	7820
4	21yrs	f	Student	156cm	81.5	33.48	97	127/78	12319	93	119/90	11067
5	22yrs	m	Student	149cm	76.5	34.45	96	118/85	11328	83	111/74	9213
6	21yrs	m	Student	160cm	80.5	31.44	69	109/75	7521	65	105/70	6825
7	19yrs	f	Student	146cm	68	31.9	99	115/81	11385	86	113/74	9718
8	19yrs	f	Student	150cm	68.5	30.44	68	107/66	7276	71	94/60	6390
9	19yrs	m	Student	145cm	65.5	31.153	86	124/70	10664	84	117/57	9828
10	21yrs	f	Student	150cm	69	30.66	90	108/79	9720	88	97/72	8536
11	20yrs	m	Student	153cm	71.5	30.54	84	113/75	9492	82	109/74	8938
12	21yrs	f	Student	156cm	78.5	32.25	78	128/78	9984	71	117/80	8307
13	20yrs	f	Student	150cm	71	31.55	75	109/77	8393	85	102/82	8670
14	21yrs	f	Student	154cm	73.5	30.99	68	115/69	7820	74	109/70	8066
15	30yrs	m	Tutor	158cm	83	33.24	80	130/85	10400	90	134/80	12060
16	35yrs	m	Professor	161cm	90	34.72	68	136/80	9248	75	131/86	9825
17	21yrs	m	Student	159cm	86	34.01	67	116/75	7772	79	121/90	8769
18	32yrs	m	Tutor	153cm	78	33.32	78	125/84	9750	80	119/86	9520
19	34yrs	m	Teacher	158cm	80	32.04	68	136/90	9248	75	140/98	13720
20	29yrs	f	Professor	155cm	76	31.63	68	128/83	8704	77	130/90	10010
21	33yrs	m	Tutor	162cm	91	34.67	89	134/87	11926	90	129/78	11610
22	32yrs	m	Tutor	158cm	86	34.44	78	129/85	10065	80	125/90	10000
23	34yrs	m	Tutor	160cm	89	34.76	89	134/96	11926	86	130/100	11180
24	23yrs	m	Student	165cm	86	31.58	78	126/80	9828	76	127/89	9652
25	35yrs	f	Clerk	156cm	81	33.28	90	132/90	11880	93	129/80	11997
26	21yrs	f	Student	154cm	78	32.88	68	121/76	8228	76	119/80	9044
27	34yrs	m	Clerk	159cm	88	34.8	78	135/90	10530	85	140/90	11900
28	20yrs	f	Student	154cm	75	31.62	64	119/70	7616	76	115/75	8740
29	32yrs	f	Clerk	156cm	78	32.05	68	125/80	8500	75	122/89	9150
30	34yrs	m	Teacher	158cm	80	32.04	78	138/89	10764	89	128/77	11392
31	32yrs	f	Teacher	153cm	75	32.03	68	130/85	8840	70	125/70	8750
32	21yrs	f	Student	152cm	70	30.29	65	119/70	7735	68	120/89	8160
33	31yrs	m	Tutor	155cm	75	31.21	76	130/89	9880	80	127/90	10320
34	20yrs	m	Student	158cm	76	30.44	69	118/78	8142	70	121/75	8470
35	31yrs	F	Tutor	154cm	81	34.15	78	127/89	9906	81	123/87	9963

S.no	AGE	SEX	OCCUPATION	HEIGHT	WEIGHT	BMI	PRE TEST VALUES			POST TEST VALUES		
36	32Yrs	f	Tutor	150cm	83	32.03	68	107/66	7276	71	94/60	6390
37	23Yrs	m	Assistant	153cm	90	22.16	86	124/70	10664	84	117/57	9828
38	28Yrs	f	Tutor	156cm	86	30.44	90	108/79	9720	88	97/72	8536
39	19Yrs	m	Student	150cm	78	21.67	84	113/75	9492	82	109/74	8938
40	21Yrs	m	Student	154cm	80	28.09	78	128/78	9984	71	117/80	8307
41	27Yrs	f	Assistant	158cm	76	32.07	75	109/77	8393	85	102/82	8670
42	33Yrs	f	Professor	161cm	91	31.24	68	115/69	7820	74	109/70	8066
43	20Yrs	m	Student	159cm	86	21.56	80	130/85	10400	90	134/80	12060
44	34Yrs	f	Professor	153cm	89	34.08	68	136/80	9248	75	131/86	9825
45	26Yrs	m	Assistant	158cm	86	32.22	67	116/75	7772	79	121/90	8769
46	29Yrs	f	Tutor	155cm	81	30.11	78	125/84	9750	80	119/86	9520
47	31Yrs	m	Tutor	162cm	78	34.33	68	136/90	9248	75	140/98	13720
48	35Yrs	f	Professor	158cm	88	32.87	68	128/83	8704	77	130/90	10010
49	24Yrs	m	Assistant	160cm	83	25.12	89	134/87	11926	90	129/78	11610
50	22Yrs	m	Student	165cm	90	23.01	78	129/85	10065	80	125/90	10000

ANNEXURE – V

PATIENT CONSENT FORM

I ………………………………………………………… voluntarily consent to participate in the research named on "EFFECTS OF UPPER EXTREMITY ISOMETRIC EXERCISES ON CARDIOVASCULAR RESPONSES IN NORMAL AND OBESE INDIVIDUALS".

The researcher has explained me the treatment approach in brief, risk of participation and has answered the questions related to the study to my satisfaction.

Signature of patient **Signature of researcher**

Signature of witness

Place:

Date: